Deutsches Institut für Bautechnik

Approval body for construction products and types of construction

Bautechnisches Prüfamt

An institution established by the Federal and Laender Governments

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

European Technical Assessment ETA-15/0555 of 11 September 2015

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	Upat injection system UPM 44 for use in masonry
Product family to which the construction product belongs	Injection system for use in masonry
Manufacturer	fischerwerke GmbH & Co. KG Otto-Hahn-Straße 15 79211 Denzlingen DEUTSCHLAND
Manufacturing plant	fischerwerke
This European Technical Assessment contains	98 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	Guideline for European technical approval of "Metal Injection Anchors for Use in Masonry", ETAG 029, April 2013, used as European Assessment Document (EAD) according to Article 66 Paragraph 3 of Regulation (EU) No 305/2011.

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Specific Part

1 Technical description of the product

The Upat injection system UPM 44 for masonry is a bonded anchor (injection type) consisting of a mortar cartridge with Upat injection mortar UPM 44, UPM 44 Express and UPM 44 Relax, a perforated sieve sleeve and an anchor rod with hexagon nut and washer or an internal threaded rod in the range of M6 to M16. 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 anchor is used in compliance with the specifications and conditions given in Annex B.

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

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

3.1 Mechanical resistance and stability (BWR 1)

Essential characteristic	Performance
Characteristic resistance for tension and shear loads	See Annex C 1 – C 75
Characteristic resistance for bending moments	See Annex C 76
Displacements under shear and tension loads	See Annex C 78
Reduction Factor for job site tests (β-Factor)	See Annex C 78
Edge distances and spacing	See Annex C 1 – C 75

3.2 Safety in case of fire (BWR 2)

Essential characteristic	Performance
Reaction to fire	Anchorages satisfy requirements for Class A1
Resistance to fire	No performance assessed

3.3 Hygiene, health and the environment (BWR 3)

Regarding dangerous substances there may be requirements (e.g. transposed European legislation and national laws, regulations and administrative provisions) applicable to the products falling within the scope of this European Technical Assessment. In order to meet the provisions of Regulation (EU) No 305/2011, these requirements need also to be complied with, when and where they apply.

3.4 Safety in use (BWR 4)

The essential characteristics regarding Safety in use are included under the Basic Works Requirement Mechanical resistance and stability.

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

In accordance with guideline for European technical approval ETAG 029, April 2013, used as European Assessment Document (EAD) according to Article 66 Paragraph 3 of Regulation (EU) No 305/2011, 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 11 September 2015 by Deutsches Institut für Bautechnik

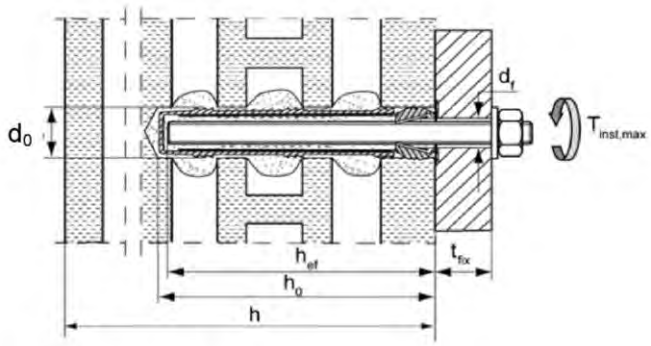
Andreas Kummerow
p.p. Head of Department

beglaubigt:
Baderschneider

Deutsches Institut für Bautechnik DIBt

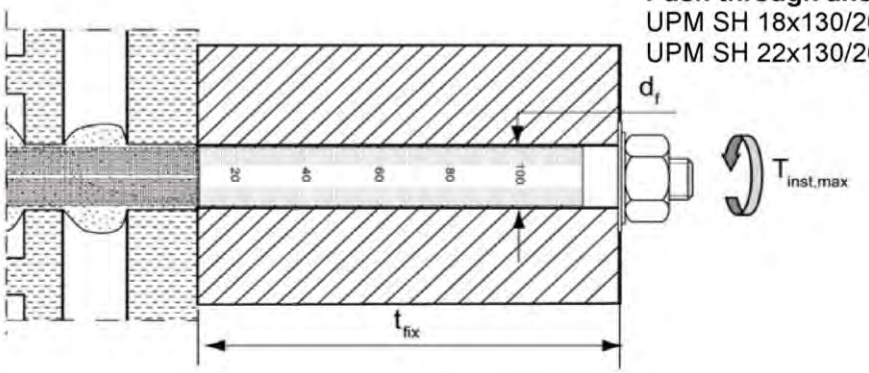
Installation conditions part 1

Threaded rods with perforated sleeve UPM SH K; Installation in perforated and solid brick masonry



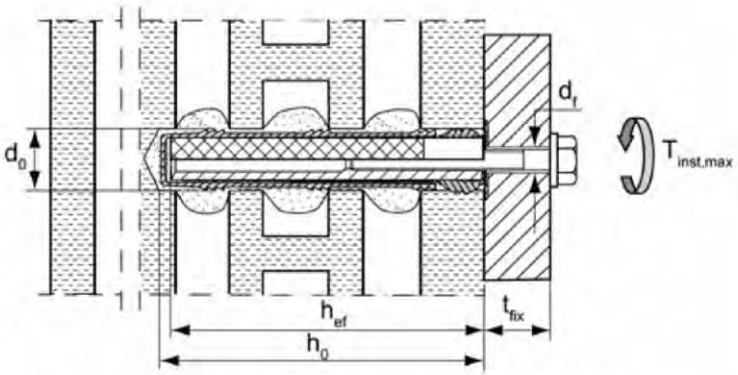
Pre-positioned anchorage
UPM SH 12x50 K
UPM SH 12x85 K
UPM SH 16x85 K
UPM SH 16x130 K
UPM SH 20x85 K
UPM SH 20x130 K
UPM SH 20x200 K

Push through anchorage
UPM SH 18x130/200 K
UPM SH 22x130/200 K



Internal threaded anchor UPM-I with perforated sleeve UPM SH K; Installation in perforated and solid brick masonry

Pre-positioned anchorage



d_0 = nominal drill bit diameter
d_f = diameter of clearance hole in the fixture
$T_{inst,max}$ = maximum torque moment
h = thickness of masonry

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

Upat injection system UPM 44 masonry	**Annex A 1**
Product description Installation conditions part 1, in perforated brick	

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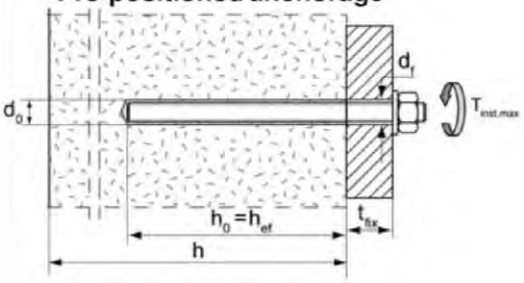
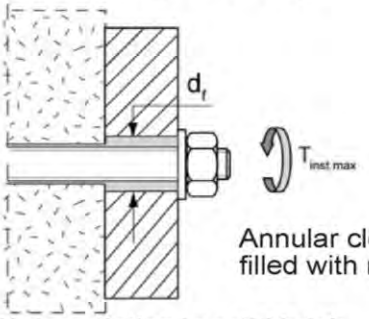
Installation conditions part 2

Threaded rods without perforated sleeve UPM SH K; installation in solid brick masonry and autoclaved aerated concrete

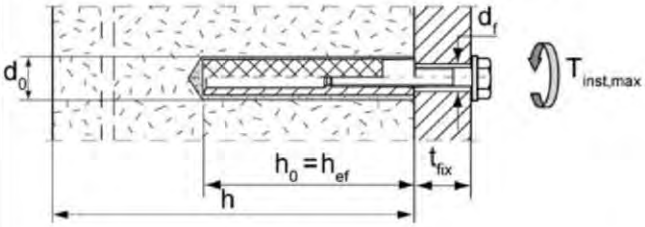
Pre-positioned anchorage



Push-through anchorage



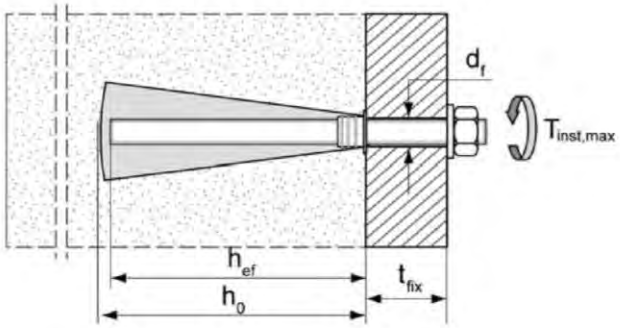
Internal threaded anchors UPM-I without perforated sleeve UPM SH K; installation in solid brick masonry and autoclaved aerated concrete



Threaded rods and internal threaded anchors UPM-I without perforated sleeve UPM SH K; installation in autoclaved aerated concrete (installation with special conic drill bit PBB)

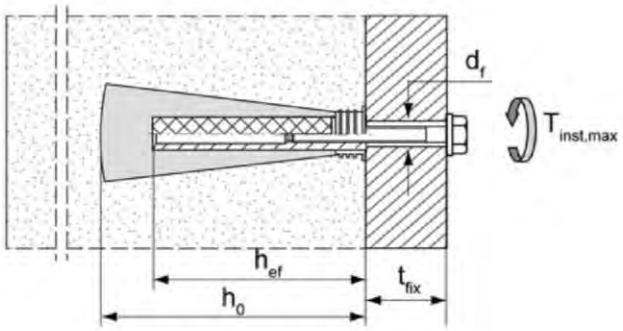
Threaded rods M8, M10, M12

Pre-positioned anchorage



Internal threaded anchor UPM-I M6 and UPM-I M8

Pre-positioned anchorage



d_0 = nominal drill bit diameter
d_f = diameter of clearance hole in the fixture
$T_{inst,max}$ = maximum torque moment
h = thickness of masonry

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

Upat injection system UPM 44 masonry	**Annex A 2**
Product description Installation conditions part 2, in solid bricks	

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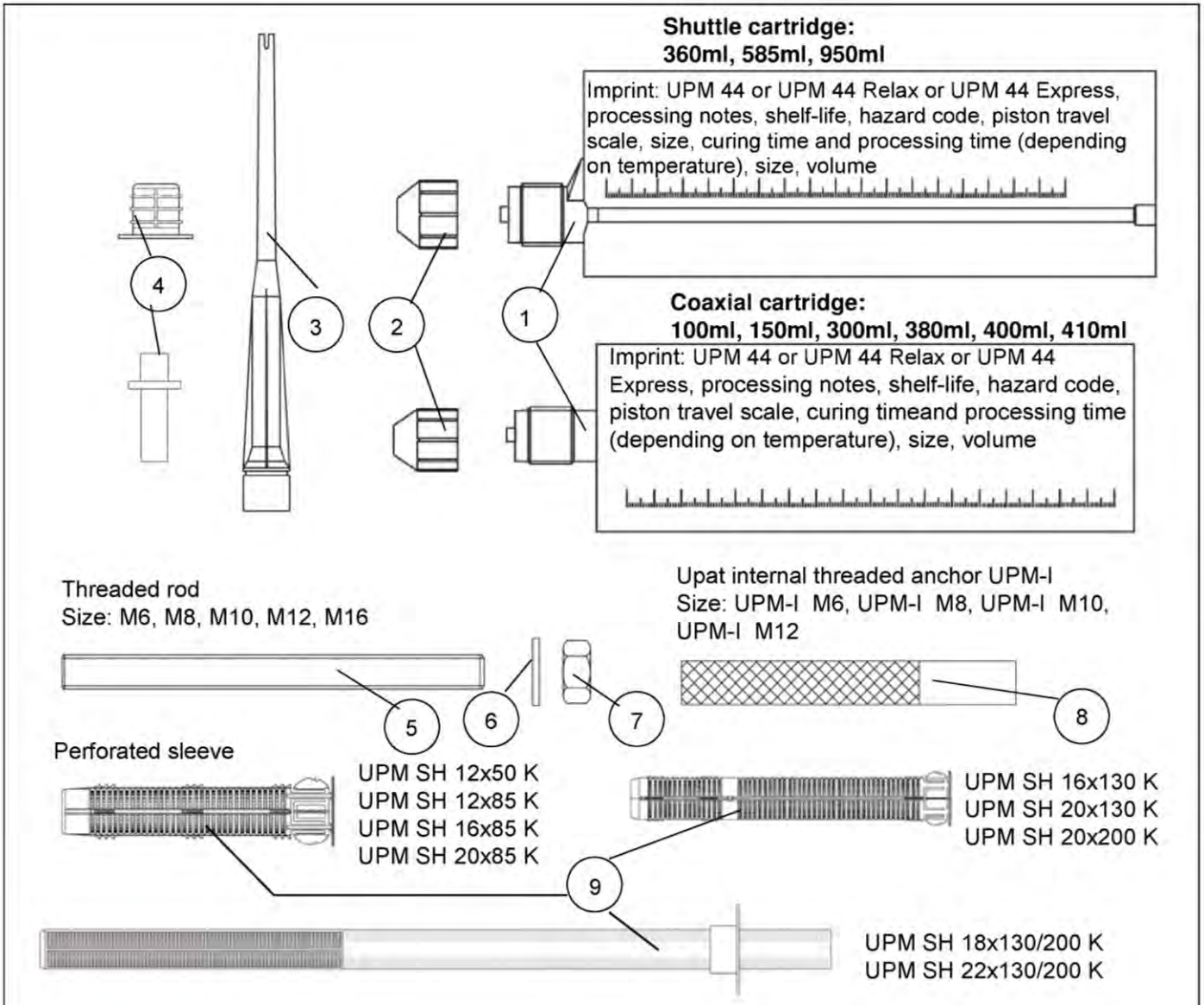

① Mortar cartridge
② Sealing cap
③ Static mixer ME (Easy Mixer); MR
④ Injection adapter and center nozzle for aerated concrete
⑤ Threaded rod
⑥ Washer
⑦ Hexagon nut
⑧ Internal threaded anchor UPM-I
⑨ Perforated sleeve UPM SH K

Upat injection system UPM 44 masonry	
Product description Product	**Annex A 3**

Table A1: Materials

Part	Designation	Material		
1	Mortar cartridge	Mortar, hardener; filler		
		Steel, zinc plated	Stainless steel A4	High corrosion-resistant steel C
5	Threaded rod	Property class 5.8 or 8.8; EN ISO 898-1: 2013 zinc plated ≥ 5µm, EN ISO 4042:1999 A2K or hot-dip galvanised EN ISO 10684:2004 $f_{uk} \leq 1000$ N/mm² $A_5 > 8\%$ fracture elongation	Property class 50, 70 or 80 EN ISO 3506:2009 1.4401; 1.4404; 1.4578; 1.4571; 1.4439; 1.4362; 1.4062 EN 10088-1:2014 $f_{uk} \leq 1000$ N/mm² $A_5 > 8\%$ fracture elongation	Property class 50 or 80 EN ISO 3506:2009 or property class 70 with f_{yk}= 560 N/mm² 1.4565; 1.4529 EN 10088-1:2014 $f_{uk} \leq 1000$ N/mm² $A_5 > 8\%$ fracture elongation
6	Washer ISO 7089:2000	zinc plated ≥ 5µm, EN ISO 4042:1999 A2K or hot-dip galvanised EN ISO 10684:2004	1.4401; 1.4404; 1.4578;1.4571; 1.4439; 1.4362 EN 10088-1:2014	1.4565;1.4529 EN 10088-1:2014
7	Hexagon nut	Property class 5 or 8; EN ISO 898-2:2013 zinc plated ≥ 5µm, ISO 4042:1999 A2K or hot-dip galvanised ISO 10684:2004	Property class 50, 70 or 80 EN ISO 3506:2009 1.4401; 1.4404; 1.4578; 1.4571; 1.4439; 1.4362 EN 10088-1:2014	Property class 50, 70 or 80 EN ISO 3506:2009 1.4565; 1.4529 EN 10088-1:2014
8	Internal threaded anchor UPM-I	Property class 5.8; EN 10277-1:2008-06 zinc plated ≥ 5µm, ISO 4042:1999 A2K	Property class 70 EN ISO 3506:2009 1.4401; 1.4404; 1.4578; 1.4571; 1.4439; 1.4362 EN 10088-1:2014	Property class 70 EN ISO 3506-1:2009 1.4565; 1.4529 EN 10088-1:2014
	Screw or threaded rod for internal threaded anchor UPM-I	Property class 5.8 or 8.8; EN ISO 898-1:2013 zinc plated ≥ 5µm, ISO 4042:1999 A2K	Property class 70 EN ISO 3506:2009 1.4401; 1.4404; 1.4578; 1.4571; 1.4439; 1.4362 EN 10088-1:2014	Property class 70 EN ISO 3506-1:2009 1.4565; 1.4529 EN 10088-1:2014
9	Perforated sleeve	PP / PE		

Upat injection system UPM 44 masonry	**Annex A 4**
Product description Materials	

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Specifications of intended use

Anchorages subject to:

- Static and quasi-static loads

Base materials:

- Solid brick masonry (Use category b) and autoclaved aerated concrete (Use category d), acc. to Annex B10, B11, B12

  Note: The characteristic resistance is also valid for larger brick sizes and higher compressive strength of the masonry unit.
- Hollow brick masonry (use category c), according to Annex B10, B11
- Mortar strength class of the masonry M2,5 at minimum according to EN 998-2:2010
- For other bricks in solid masonry and in hollow or perforated masonry and autoclaved aerated concrete, the characteristic resistance of the anchor may be determined by job site tests according to ETAG 029, Annex B under consideration of the β-factor according to Annex C78, Table C121

Temperature Range:

- **I**: From - 40°C to +80°C (max. short term temperature +80°C and max. long term temperature +50°C)
- **II**: From -40°C to +120°C (max. short term temperature +120°C and max. long term temperature +72°C)

Use conditions (Environmental conditions):

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

  Note: Particular aggressive conditions are e.g. permanent, alternating immersion in seawater or the splash zone of seawater, chloride atmosphere of indoor swimming pools or atmosphere with extreme chemical pollution (e.g. in desulphurization plants or road tunnels where de-icing materials are used)

Upat injection system UPM 44 masonry	
Intended Use Specifications	**Annex B 1**

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Specifications of intended use

Design:

- The anchorages have to be designed in accordance with the ETAG 029, Annex C, Design method A under the responsibility of an engineer experienced in anchorages and masonry work

  Applies to all bricks, if no other values are specified:

  $N_{Rk} = N_{Rk,s} = N_{Rk,p} = N_{Rk,b} = N_{Rk,pb}$

  $V_{Rk} = V_{Rk,s} = V_{Rk,b} = V_{Rk,c} = V_{Rk,pb}$

- Verifiable calculation notes and drawings have to be 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

Installation:

- Category d/d: -Installation and use in dry structures
- Category w/w: -Installation and use in dry and wet structures
- Hole drilling by hammer drill mode
- In case of aborted hole: The hole shall be filled with mortar
- Bridging of unbearing layer (e.g. plaster) see Annex B 4 (Table B3)
- Anchor installation carried out by appropriately qualified personnel and under the supervision of the person responsible for technical matters of the site
- Fastening screws or threaded rods (including nut and washer) must comply with the appropriate material and property class of the Upat internal threaded anchor UPM-I
- minimum curing time see Annex B5. Table B6
- Commercial standard threaded rods, washers and hexagon nuts may also be used if the following requirements are fulfilled:

  Material dimensions and mechanical properties of the metal parts according to the specifications are given in Annex A4, Table A1

  Conformation of material and mechanical properties of the metal parts by inspection certificate 3.1 according to EN 10204:2004, the documents shall be stored

  Marking of the threaded rod with the envisage embedment depth. This may be done by the manufacturer of the rod or by a person on job site

Upat injection system UPM 44 masonry	
Intended Use Specifications	**Annex B 2**

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Table B1: Installation parameters for threaded rods in solid bricks and autoclaved aerated concrete without perforated sleeves

Size		M6	M8	M10	M12	M16
Nominal drill hole diameter	d_0 [mm]	8	10	12	14	18
Effective anchorage depth AAC cylindrical drill hole h_{ef} [1)]	$h_{ef,min}$ [mm]	100				
Effective anchorage depth AAC Conical drill hole h_{ef} [1)]	$h_{0,min}$ [mm]	-	80			-
	$h_{ef,min}$ [mm]	-	75			-
Effective anchorage depth h_{ef} [1)]	$h_{ef,min}$ [mm]	50				
Depth of drill hole $h_0 = h_{ef}$	$h_{ef,max}$ [mm]	h-30, ≤200				
Diameter of clearance hole in the fixture	pre-position $d_f \leq$ [mm]	7	9	12	14	18
	push through $d_f \leq$ [mm]	9	11	14	16	20
Diameter of steel brush	$d_b \geq$ [mm]	See Table B5				
Maximum installation torque	$T_{inst,max}$ [Nm]	see parameters of brick				

[1)] $h_{ef,min} \leq h_{ef} \leq h_{ef,max}$ is possible.

Upat threaded rods M6, M8, M10, M12, M16

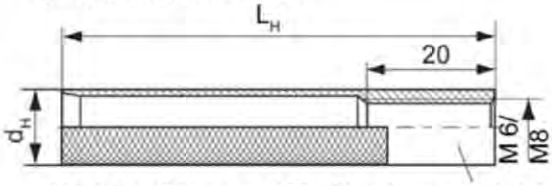
Marking:
Property class 8.8 or high corrosion resistant steel, property class 80: •
Stainless steel A4, property class 50 and high corrosion resistant steel C, property class 50: ••

Table B2: Installation parameters for internal threaded anchors UPM-I in solid bricks and autoclaved aerated concrete without perforated sleeves

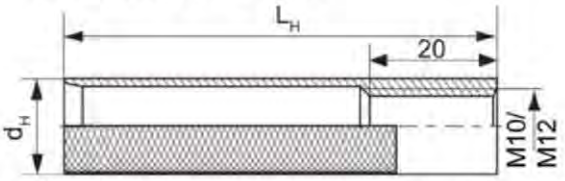
Size UPM-I...		M6	M8	M10	M12
Diameter of anchor	d_H [mm]	11		15	
Nominal drill bit diameter	d_0 [mm]	14		18	
Length of anchor	L_H [mm]	85			
Drill hole depth	$h_0 = h_{ef}$ [mm]	85			
Effective anchorage depth	h_{ef} [mm]	85			
Effective anchorage depth AAC Conical drill hole h_{ef} [1)]	h_0 [mm]	100		-	
	h_{ef} [mm]	85			
Diameter of steel brush	$d_b \geq$ [mm]	See Table B5			
Maximum installation torque	$T_{inst,max}$ [Nm]	see parameters of brick			
Diameter of clearance hole in the fixture	d_f [mm]	7	9	12	14
Screw-in depth	$l_{E,min}$ [mm]	6	8	10	12
	$l_{E,max}$ [mm]	60			

Upat Internal threaded anchor UPM-I

UPM-I M6, UPM-I M8



UPM-I M10, UPM-I M12



Marking: Size, e.g. **M8,** Stainless steel: A4, e.g. **M8 A4** High corrosion resistant steel: C, e.g. **M8 C**

Upat injection system UPM 44 masonry

Intended Use
Installation parameters threaded rods and internal threaded anchors UPM-I without perforated sleeves

Annex B 3

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Table B3: Installation parameters for threaded rods and internal threaded anchors UPM-I with perforated sleeves (pre-positioned anchorage)

Size UPM SH K		12x50	12x85	16x85	16x130[2)]	20x85	20x130[2)]	20x200[2)]
Nominal drill hole diameter $d_0 = D_{sleeve,nom}$	d_0 [mm]	12		16		20		
Depth of drill hole	h_0 [mm]	55	90	90	135	90	135	205
Effective anchorage depth	$h_{ef,min}$ [mm]	50	85	85	110	85	110	180
	$h_{ef,max}$ [mm]	50	85	85	130	85	130	200
Size of threaded rod	[-]	M6 or M8		M8 or M10		M12 or M16		
Size of internal threaded anchor UPM-I		---	---	M6/M8	---	M10/M12	---	---
Diameter of steel brush[1)]	$d_b \geq$ [mm]	See Table B5						
Maximum installation	$T_{inst,max}$ [Nm]	see parameters of brick						

[1)] Only for solid areas in hollow bricks and solid bricks

[2)] Bridging of unbearing layer (e.g. plaster) possible

Perforated sleeves
UPM SH 12x50 K; UPM SH 12x85 K; UPM SH 16x85 K; UPM SH 16x130 K; UPM SH 20x85 K; UPM SH 20x130 K; UPM SH 20x200 K

Marking:
Size $D_{sleeve,nom}$ x L_{sleeve}
(e. g.: 16x85)

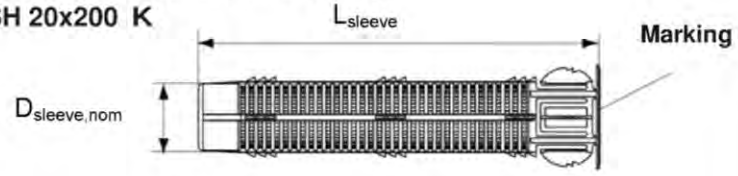
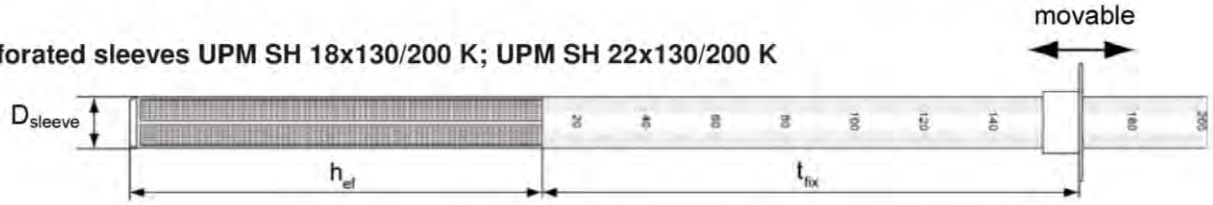


Table B4: Installation parameters for threaded rods with perforated sleeves (push through anchorage)

Size UPM SH K		18x130/200		22x130/200
Nominal sleeve diameter	$D_{sleeve,nom}$ [mm]	16		20
Nominal drill hole diameter	d_0 [mm]	18		22
Depth of drill hole	h_0 [mm]	$135 + t_{fix}$		
Effective anchorage depth	h_{ef} [mm]	≥130		
Diameter of steel brush [1)]	$d_b \geq$ [mm]	See Table B5		
Size of threaded rod	[-]	M10	M12	M16
Maximum installation torque	$T_{inst,max}$ [Nm]	see parameters of brick		
Thickness of fixture	$t_{fix,max}$ [mm]	200		

[1)] Only for solid areas in hollow bricks and solid bricks

Perforated sleeves UPM SH 18x130/200 K; UPM SH 22x130/200 K



Upat injection system UPM 44 masonry

Intended Use
Installation parameters threaded rods and internal threaded anchors UPM-I with perforated sleeves

Annex B4

Steel brush

Only for solid bricks and autoclaved aerated concrete

Table B5: Parameters of steel brush

Drill hole diameter	d_0	[mm]	8	10	12	14	16	18	20	22
Brush diameter	$d_{b,nom}$	[mm]	9	11	14	16	20	20	25	25

Table B6: Maximum processing times and minimum curing times
(During the curing time of the mortar the masonry temperature may not fall below the listed minimum temperature).

Temperature at anchoring base [°C]	Minimum curing time [1] t_{cure} [minutes]			System-temperature (mortar) [°C]	Maximum processing time t_{work} [minutes]		
	UPM 44 Express[3]	UPM 44[2]	UPM 44 Relax[2]		UPM 44 Express[3]	UPM 44[2]	UPM 44 Relax[2]
-10 to -5	12 hours						
>-5 to ±0	3 hours	24 hours		±0	5		
>±0 to +5	90	3 hours	6 hours	+5	5	13	20
>+5 to +10	45	90	3 hours	+10	3	9	20
>+10 to +20	30	60	2 hours	+20	1	5	10
>+20 to +30		45	60	+30		4	6
>+30 to +40		35	30	+40		2	4

[1] For wet bricks the curing time must be doubled
[2] Minimum cartridge temperature +5°C
[3] Minimum cartridge temperature ±0°C

Upat injection system UPM 44 masonry	
Intended Use Steel brush Maximum processing times and minimum curing times	**Annex B 5**

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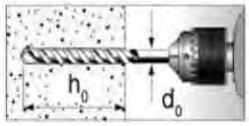
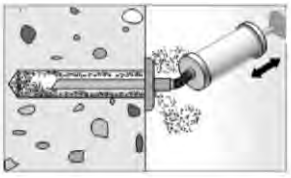
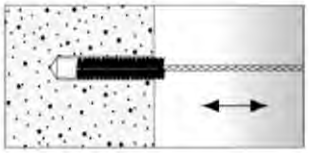
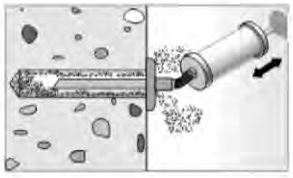
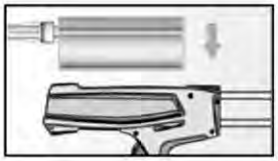
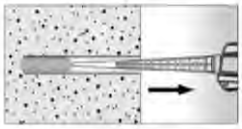
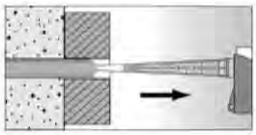
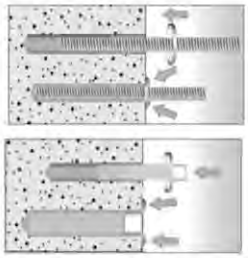
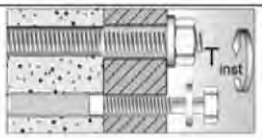
Installation instruction part 1

Installation in solid brick and autoclaved aerated concrete (without perforated sleeve)

1		Drill the hole in hammer drill function. Depth of drill hole $\mathbf{h_0}$ and drill hole diameter $\mathbf{d_0}$ see **Table B1; B2**		
2				Blow out the drill hole twice. Brush twice and blow out twice again.
3		Remove the sealing cap. Screw on the static mixer. (the spiral in the static mixer must be clearly visible)		
4		Place the cartridge into a suitable dispenser		Press out approximately 10 cm of mortar until the resin is permanently grey in colour. Mortar which is not grey in colour will not cure and must be disposed of.
5		Fill approximetly 2/3 of the drill hole with mortar beginning from the bottom of the hole[1)]. Avoid bubbles!		For push through anchorage fill the annular clearance with mortar.
6		Only use clean and oil-free anchor elements. Mark the threaded rod for setting depth. Insert the anchor or internal threaded anchor UPM-I by hand using light turning motions. When reaching the setting depth marking, excess mortar must emerge from the mouth of the drill hole.		
7		Do not touch. Minimum curing time see **Table B6.**		Mounting the fixture. $T_{inst,max}$ see parameter of brick.

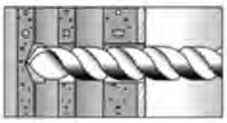
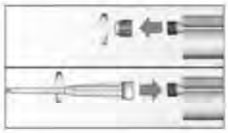
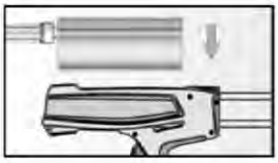
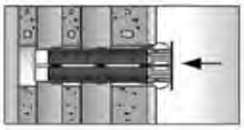
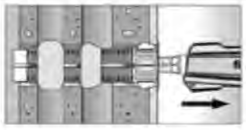
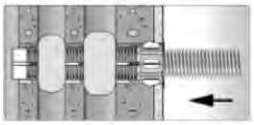
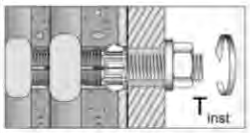
[1)] Exact volume of mortar see manufacturer´s specification.

Upat injection system UPM 44 masonry	**Annex B 6**
Intended Use Installation instruction (without perforated sleeve) Part 1	

Deutsches Institut für Bautechnik DIBt

Installation instruction, part 2

Installation in perforated or solid brick with perforated sleeve (pre-positioned anchorage)

1		Drill the hole (hammer drill). Depth of drill hole h_0 and drill hole diameter d_0 see **Table B3**	When install perforated sleeves in solid bricks or solid areas of hollow bricks, also clean the hole by blowing out and brushing.	
2		Remove the sealing cap. Screw on the static mixer. (the spiral in the static mixer must be clearly visible)		
3		Place the cartridge into a suitable dispenser		Press out approximately 10 cm of mortar until the resin is permanently grey in colour. Mortar which is not grey in colour will not cure and must be disposed of.
4		Insert the perforated sleeve flush with the surface of the masonry or plaster		Fill the perforated sleeve completely with mortar beginning from the bottom of the hole[1)].
5		Only use clean and oil-free anchor elements. Mark the threaded rod for setting depth. Insert the threaded rod or the internal threaded anchor UPM-I by hand using light turning motions until reaching the setting depth marking (threaded rod) or flush with the surface (internal threaded anchor).		
6		Do not touch. Minimum curing time see **Table B6.**		Mounting the fixture. $T_{inst,max}$ see parameter of brick.

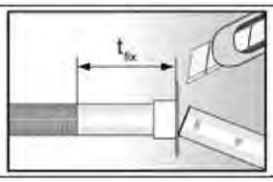
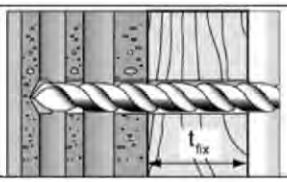
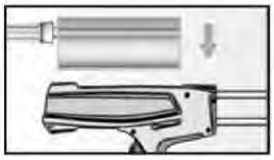
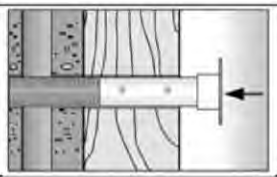
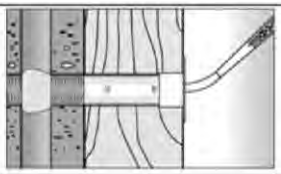
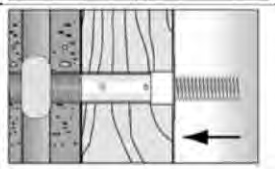
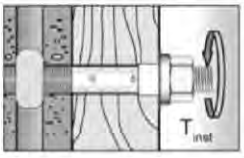
[1)] Exact volume of mortar see manufacturer´s specification.

Upat injection system UPM 44 masonry	**Annex B 7**
Intended Use Installation instruction (with perforated sleeve) Part 2	

Deutsches Institut für Bautechnik DIBt

Installation instruction, part 3

Installation in perforated or solid brick with perforated sleeve (push through anchorage)

1		Push the movable stop up to the correct thickness of fixture and cut the overlap.		Drill the hole through the fixture. Depth of drill hole **(h_0 + t_{fix})** and drill hole diameter see **Table B4.**
2		Remove the sealing cap. Screw on the static mixer. (the spiral in the static mixer must be clearly visible)		
3		Place the cartridge into a suitable dispenser		Press out approximately 10 cm of mortar until the resin is permanently grey in colour. Mortar which is not grey in colour will not cure and must be disposed of.
4		Insert the perforated sleeveflush with the surface of the fixture into the drill hole.		Fill the sleeve with mortar beginning from the bottom of the hole.[1] For deep drill holes use an extension tube.
5		Only use clean and oil-free anchor elements. Mark the threaded rod for setting depth. Insert the threaded rod by hand using light turning motions until reaching the setting depth marking.		
6		Do not touch. Minimum curing time see **Table B6.**		Mounting the fixture. $T_{inst,max}$ see parameter of brick.

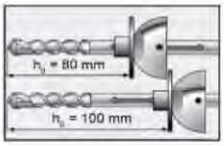
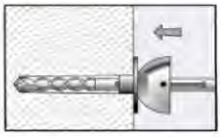
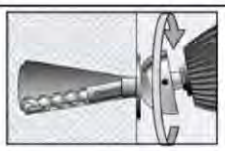
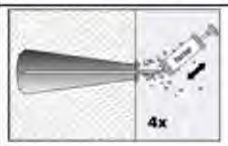
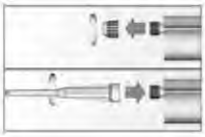
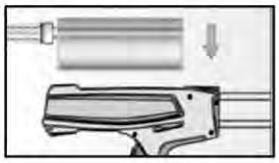
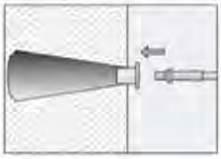
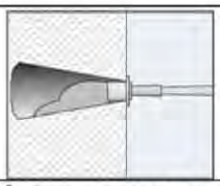
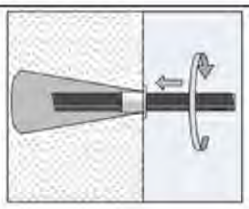
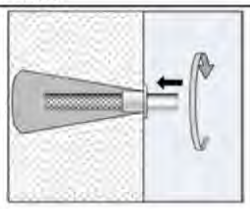
[1] Exact volume of mortar see manufacturer´s specification.

Upat injection system UPM 44 masonry	**Annex B 8**
Intended Use Installation instruction (with perforated sleeve) Part 3	

Deutsches Institut für Bautechnik DIBt

Installation instruction, part 4

Installation in autoclaved aerated concrete with special conic drill bit PBB (pre-positioned anchorage)

1		Position the movable drill bit arrester on the used drill hole depth. For this, unlock the clamp screw and slide the arrester. Now fix the clamp screw.		
2		Drill the cylindrical hole with rotating drill until the arrester contact the material surface.		
3		Deviate the working power drill circulate to generate an conic undercut in the material.		
4		Blow out the drill hole four times.		
5		Remove the sealing cap. Screw on the static mixer. (the spiral in the static mixer must be clearly visible)		
6		Place the cartridge into a suitable dispenser		Press out approximately 10 cm of mortar until the resin is permanently grey in colour. Mortar which is not grey in colour will not cure and must be disposed of.
7		Put the center sleeve into the drill hole and adapt the injection adapter onto the static mixer		Fill the drill hole with injection mortar.
8			Only use clean and oil-free anchor elements. Mark the threaded rod for setting depth.Insert the anchor or internal threaded anchor UPM-I by hand using light turning motions. When reaching the setting depth marking,excess mortar must emerge from the mouthof the drill hole.	
9		Do not touch. Minimum curing time see **Table B6.**		Mounting the fixture. $T_{inst,max}$ see parameter of brick.

Upat injection system UPM 44 masonry	
Intended Use Installation instruction (without perforated sleeve special conic drill bit PBB) Part 4	**Annex B 9**

Table B7.1: Summary of German bricks and blocks

Kind of masonry	Brick format [mm]	Compressive strength [N/mm²]	Density [kg/dm³]	Annex
Solid bricks				
Solid brick **Mz** EN 771-1	≥ 240x115x113	10 / 16	≥1,8	C1/C2
Solid brick **Mz** EN 771-1	≥ 240x115x71	10 / 20	≥1,8	C3/C4
Solid sand- lime brick **KS** EN 771-2	≥ 250x240x240	10 / 20 / 28	≥2,0	C5/C6/C7
Solid light-weight concrete block **Vbl**	≥ 372x300x254	2	≥0,6	C8/C9
Solid light-weight concrete block **Vbl**	≥ 250x240x239	4 / 6 / 8	≥1,6	C10/C11/C12
Perforated bricks and hollow blocks				
Perforated brick **HLz** EN 771-1 e.g. Poroton	500(370)x175(240)x237	4 / 6 / 8 / 10 / 12	≥1,0	C13/C14/C15
Perforated brick **HLz** EN 771-1	240x115x113	6 / 10 / 16 / 20 / 28	≥1,4	C16/C17/C18
Sand- lime hollow block **KSL**	240x175x113	8 / 10 / 12 / 16 / 20	≥1,4	C19/C20/C21
Light-weight concrete hollow block **Hbl**	362x240x240	2 / 4	≥1,0	C22/C23/C24

Table B7.2: Summary of French bricks and blocks

Kind of masonry	Brick format [mm]	Compressive strength [N/mm²]	Density [kg/dm³]	Annex
Perforated bricks and hollow blocks				
Perforated brick **HLz** EN 711-1	500x200x315	4 / 6 / 8	≥0,6	C25/C26/C27
Perforated brick **HLz** EN 711-1	500x200x300	4 / 6 / 8 / 10	≥0,7	C28/C29/C30
Perforated brick **HLz** EN 711-1	500x200x315	2 / 4 / 6 / 8	≥0,7	C31/C32/C33
Perforated brick **HLz** EN 711-1	520x200x275	4 / 6 / 8	≥0,7	C34/C35
Light-weight concrete hollow block **Hbl**	500x200x200	2 / 4 / 6	≥1,0	C36/C37

Upat injection system UPM 44 masonry	**Annex B 10**
Intended Use Summary of especially German and French bricks and blocks	

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Table B7.3: Summary of Italian bricks

Kind of masonry	Brick format [mm]	Compressive strength [N/mm²]	Density [kg/dm³]	Annex
Solid bricks				
Solid brick **Mz** EN 771-1	≥ 245x118x54	10 / 20	≥1,8	C38/C39
Perforated bricks				
Perforated brick **HLz** EN 771-1	255x120x118	2 / 4 / 6 / 8 / 10 / 12	≥1,0	C40/C41/C42
Perforated brick **LLz** EN 771-1	248x78x250	2 / 4 / 6	≥0,7	C43/C44

Table B7.4: Summary of Spanish and Portuguese bricks

Kind of masonry	Brick format [mm]	Compressive strength [N/mm²]	Density [kg/dm³]	Annex
Perforated bricks				
Perforated brick **HLz** EN 771-1	275x130x94	6 / 8 / 12 / 16 / 20	≥0,8	C45/C46/C47
Perforated bricks				
Perforated brick **LLz** EN 771-1	128x88x275	2	≥0,8	C48/C49
Perforated brick **HLz** EN 771-1	190x290x220	6 / 8 / 10	≥0,7	C50/C51/C52

Table B7.5: Summary of Austrian bricks

Kind of masonry	Brick format [mm]	Compressive strength [N/mm²]	Density [kg/dm³]	Annex
Perforated bricks				
Perforated brick **HLz** EN 771-1	253x300x240	2 / 4 / 6	≥0,8	C53/C54/C55

Table B 7.6: Summary of Irish and English bricks

Kind of masonry	Brick format [mm]	Compressive strength [N/mm²]	Density [kg/dm³]	Annex
Solid blocks				
Solid light-weight concrete brick **Vbl**	≥ 440x100x215	4 / 6 / 8 / 10	≥2,0	C56/C57
Solid light-weight concrete brick **Vbl**	≥ 440x95x215	6 / 8 / 10 / 12	≥2,0	C58/C59
Perforated blocks				
Light-weight concrete hollow block **Hbl**	440x215x215	4 / 6 / 8 / 10	≥1,2	C60/C61/C62

Upat injection system UPM 44 masonry	
Intended Use Summary of especially Italian, Spanish, Portuguese, Austrian, Irish an English bricks and blocks	**Annex B 11**

Deutsches Institut für Bautechnik DIBt

Table B7.7: Summary of Dutch and Danish bricks and blocks

Kind of masonry	Brick format [mm]	Compressive strength [N/mm²]	Density [kg/dm³]	Annex
Solid bricks				
Solid brick **Mz** EN 771-1	≥ 230x108x55	10 / 20	≥1,8	C63/C64
Solid sand-lime brick **KS** EN 771-2	≥ 997x214x538	10 / 20 / 36	≥1,8	C65/C66/C67
Perforated bricks				
Perforated brick **HLz** EN 771-1	230x108x55	2 / 4 / 6 / 8	≥1,4	C68/C69/C70

Table B7.8: Summary of autoclaved aerated concrete blocks

Autoclaved aerated concrete			
Property class		**Density [kg/dm³]**	**Annex**
2 / 4 / 6	**Cylindrical drill hole**	350, 500, 650	C71/C72/C73
	Conical drill hole (special drill bit PBB)	350, 500, 650	C74/C75

Upat injection system UPM 44 masonry	
Intended Use Summary of especially Danish and Dutch bricks and blocks Summary of autoclaved aerated concrete	**Annex B 12**

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Kind of masonry: Solid brick Mz, 2 DF

Table C1: Parameters of brick

Species of brick		Solid brick Mz, 2DF
Density	$\rho \geq$ [kg/dm^3]	1.8
Compressive strength	$f_b \geq$ [N/mm^2]	10 or 16
Standard or approval		EN 771-1
Producer		e.g. Wienerberger
Size, dimensions	[mm]	≥ 240x115x113
Minimum thickness of masonry	h_{min} [mm]	115

Table C2: Installation parameters for threaded rod and internal threaded anchor without perforated sleeve

Size of threaded rod		M6		M8		M10		M12		M16		UPM-I[1)] M6/M8	UPM-I M10/M12
Effective anchorage depth	h_{ef} [mm]	50	100	50	100	50	100	50	100	50	100	85	85
Edge distance	c_{min} [mm]	60											
Spacing	s_{min} ∥ [mm]	120											
	s_{cr} ∥ [mm]	240											
	$s_{cr}{}^{\perp} = s_{min}{}^{\perp}$ [mm]	115											
Group-factor	$\alpha_{g,N}$ ∥ [-]	1,5											
	$\alpha_{g,V}$ ∥ [-]	1,4											
	$\alpha_{g,N}{}^{\perp}$ [-]	2,0											
	$\alpha_{g,V}{}^{\perp}$ [-]												
Max. installation torque	$T_{inst,max}$ [Nm]	4		10									

[1)] For UPM-I with screw M6: $T_{inst,max}$ = 4 Nm

Table C3: Installation parameters for threaded rod and internal threaded anchor UPM-I with perforated sleeve

Size of perforated sleeve		16x85			
Size of threaded rod		M8	M10	M6	M8
Size of internal threaded anchor UPM-I				UPM-I	
Edge distance	c_{min} [mm]	60			
Spacing	s_{min} ∥ [mm]	120			
	s_{cr} ∥ [mm]	240			
	$s_{cr}{}^{\perp} = s_{min}{}^{\perp}$ [mm]	115			
Group-factor	$\alpha_{g,N}$ ∥ [-]	1,5			
	$\alpha_{g,V}$ ∥ [-]	1,4			
	$\alpha_{g,N}{}^{\perp}$ [-]	2			
	$\alpha_{g,V}{}^{\perp}$ [-]				
Max. installation torque	$T_{inst,max}$ [Nm]	10		4	10

Upat injection system UPM 44 masonry

Performances
Solid brick Mz, 2DF
Species of brick, installation parameters

Annex C 1

Kind of masonry: Solid brick Mz 2 DF

Table C4: Characteristic values of resistance; tension load (N_{RK})

Use category		w/w		d/d	
Temperature range [°C]		50/80	72/120	50/80	72/120
Effective anchorage depth	Anchor size	characteristic values N_{Rk} [kN]			
Compressive strength f_b = 10 N/mm²					
50	M6, M8, M10	1,50	1,50	3,00	2,50
	M12, M16	2,00			
85	UPM-IM6/M8, UPM-I M10/M12				
100	M10	3,00	2,50	4,50	4,00
	M12, M16	3,50		5,50	4,50
Perforated sleeve 16x85	UPM-I M6/M8, M8, M10	1,50	1,20	3,00	2,50
Compressive strength f_b = 16 N/mm²					
50	M6, M8	2,50	2,00	4,50	4,00
	M10				3,50
	M12, M16	3,50	2,00	5,50	4,50
85	UPM-I M6/M8,UPM-I M10/M12				
100	M6, M8	4,00	3,00	7,00	5,50
	M10	4,50	4,00	7,50	6,50
	M12, M16	5,50	4,50	8,00	7,00
Perforated sleeve 16x85	UPM-I M6/M8, M8, M10	2,50	2,00	4,50	4,00

Calculation of pulling out of one brick (tension load): $N_{Rk,pb}$ see ETAG 029, Annex C

Table C5: Characteristic values of resistance; shear load (V_{Rk})

Use category		w/w		d/d	
Temperature range [°C]		50/80	72/120	50/80	72/120
Effective anchorage depth	Anchor size	characteristic values V_{Rk} [kN]			
Compressive strength f_b = 10 N/mm²					
≥ 50	M6	2,50			
85	UPM-I M6				
≥ 50	M8	3,00			
85	UPM-I M8				
≥ 50	M10, M12	3,50			
85	UPM-I M10/M12, M12, M16	3,00			
Compressive strength f_b = 16 N/mm²					
≥ 50	M6	4,00			
85	UPM-I M6				
≥ 50	M8	5,00			
85	UPM-I M8				
≥ 50	M10	5,50			
≥ 50	M12	5,50			
85	UPM I M10/M12, M12, M16	5,00			

Calculation of pushing out of one brick (shear load): $V_{Rk,pb}$ see ETAG 029, Annex C

Factor for iob site tests and displacements see Annex C78.

Upat injection system UPM 44 masonry	
Performances Solid brick Mz, 2DF Characteristic values	**Annex C 2**

Deutsches Institut für Bautechnik DIBt

Kind of masonry: Solid brick Mz, NF

Table C6: Parameters of brick

Species of brick		Solid brick Mz, NF
Density	$\rho \geq$ [kg/dm^3]	1.8
Compressive strength	$f_b \geq$ [N/mm^2]	10 or 20
Standard or approval		EN 771-1
Producer		e.g. Wienerberger
Size, dimensions	[mm]	≥ 240x115x71
Minimum thickness of masonry	h_{min} [mm]	115

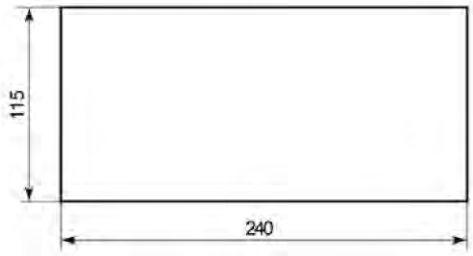

Table C7: Installation parameters (threaded rod and internal threaded anchor without perforated sleeve)

Size of threaded rod		M6		M8			M10			M12			UPM-I[1)] M6/M8
Effective anchorage depth	h_{ef} [mm]	50	80	50	80	200	50	80	200	50	80	200	85
Edge distance	c_{min} [mm]	100											
Edge distance h_{ef}=200mm	c_{min} [mm]	150											
Spacing	s_{min} II,N [mm]	60											
	h_{ef}=200 s_{min} II,N [mm]	240											
	s_{min} II,V ∫mm]	240											
	s_{cr} II [mm]	240											
	$s_{cr}\perp = s_{min}\perp$ [mm]	75											
Group-factor	$\alpha_{g,N}$ II [-]	1,5											
	$\alpha_{g,V}$ II [-]	2,0											
	$\alpha_{g,N}\perp$ [-]	2											
	$\alpha_{g,V}\perp$ [-]												
Max. installation torque	$T_{inst,max}$ [Nm]	4		10									

[1)] For UPM-I with screw M6: $T_{inst,max}$ = 4 Nm

Upat injection system UPM 44 masonry	
Performances Solid brick Mz, NF Species of brick, installation parameters	**Annex C 3**

Deutsches Institut für Bautechnik DIBt

Kind of masonry: Solid brick Mz, NF

Table C8: Characteristic values of resistance; tension load (N_{Rk})

Use category		w/w		d/d	
Temperature range [°C]		50/80	72/120	50/80	72/120
Effective anchorage depth	Anchor size	characteristic values N_{Rk} [kN]			
Compressive strength f_b = 10 N/mm²					
50	M6	2,50	2,00	4,00	3,50
	M8	2,50	2,00	4,00	3,00
	M10	2,00	1,50	3,50	3,00
80	M10	3,00	2,50	5,00	4,00
200	M10	7,50	6,50	12,00	10,50
50	M12	2,00	1,50	3,00	2,50
80	M12	3,50	3,00	5,50	4,50
200	M12	5,00	4,00	8,00	6,50
85	UPM-I M6/M8	3,50	3,00	5,50	4,50
Compressive strength f_b = 20 N/mm²					
50	M6	3,50	2,50	5,50	5,00
	M8	3,50	2,50	5,50	4,50
	M10	3,00	2,50	5,00	4,00
80	M10	4,50	3,50	7,00	6,00
200	M10	11,00	9,00	12,00	12,00
50	M12	3,00	2,50	4,50	4,00
80	M12	5,00	4,00	8,00	6,50
200	M12	7,00	6,00	11,50	9,50
85	UPM-I M6/M8	5,00	4,00	8,00	6,50

Calculation of pulling out of one brick (tension load): $N_{Rk,pb}$ see ETAG 029, Annex C

Table C9: Characteristic values of resistance; shear load (V_{Rk})

Use category		w/w		d/d	
Temperature range [°C]		50/80	72/120	50/80	72/120
Effective anchorage depth	Anchor size	characteristic values V_{Rk} [kN]			
Compressive strength f_b = 10 N/mm²					
≥ 50	M6, M8	2,50			
85	UPM-I M6/M8				
≥ 50 - 80	M10	4,00			
200	M10	8,50			
≥ 50	M12	4,00			
200	M12	11,50			
Compressive strength f_b = 20 N/mm²					
≥ 50	M6, M8	4,00			
85	UPM-I M6/M8				
≥ 50 - 80	M10	6,00			
200	M10	12,00			
≥ 50	M12	5,50			
200	M12	12,00			

Calculation of pushing out of one brick (shear load): $V_{Rk,pb}$ see ETAG 029, Annex C

Factor for iob site tests and displacements see Annex C78.

Upat injection system UPM 44 masonry	**Annex C 4**
Performances Solid brick Mz, NF Characteristic values	

Deutsches Institut für Bautechnik DIBt

Kind of masonry: Solid sand-lime block

Table C10: Parameters of brick

Species of brick		Solid sand-lime block
Density	$\rho \geq$ [kg/dm^3]	2.0
Compressive strength	$f_b \geq$ [N/mm^2]	10, 20 or 28
Standard or approval		EN 771-1
Producer		
Size, dimensions	[mm]	≥ 250x240x240
Minimum thickness of wall	h_{min} [mm]	240

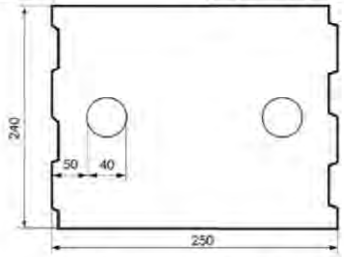

Table C11: Installation parameters for threaded rod and internal threaded anchor without perforated sleeve

Size of threaded rod		M6		M8		M10		M12		M16		UPM-I [1] M6/M8	UPM-I M10/M12
Effective anchorage depth	h_{ef} [mm]	50	100	50	100	50	100	50	100	50	100	85	85
Edge distance	c_{min} [mm]	60											
Spacing	s_{min} ∥ [mm]	80											
	s_{cr} ∥ [mm]	250											
	s_{min} ⊥ [mm]	80											
	s_{cr} ⊥ [mm]	240											
Group-factor	$\alpha_{g,N}$ ∥ [-]	1,5											
	$\alpha_{g,V}$ ∥ [-]	1,2											
	$\alpha_{g,N}$ ⊥ [-]	1,5											
	$\alpha_{g,V}$ ⊥ [-]	1,2											
Max. installation torque	$T_{inst,max}$ [Nm]	4		10									

[1] For UPM-I with screw M6: $T_{inst,max}$ = 4 Nm

Upat injection system UPM 44 masonry	
Performances Solid sand-lime block Species of brick, installation parameters	**Annex C 5**

Deutsches Institut für Bautechnik DIBt

Kind of masonry: Solid sand-lime block

Table C12: Installation parameters for threaded rod and internal threaded anchor with perforated sleeve

Size of perforated sleeve		16x85			
Size of threaded rod		M8	M10	M6	M8
Size of internal threaded anchor UPM-I				UPM-I	
Edge distance	c_{min} [mm]	60			
Spacing	s_{min} II [mm]	80			
	s_{cr} II [mm]	250			
	s_{min} ⊥ [mm]	80			
	s_{cr} ⊥ [mm]	240			
Group-factor	$\alpha_{g,N}$ II [-]	1,5			
	$\alpha_{g,V}$ II [-]	1,2			
	$\alpha_{g,N}$ ⊥ [-]	1,5			
	$\alpha_{g,V}$ ⊥ [-]	1,2			
Max. installation torque	$T_{inst,max}$ [Nm]	10		4	10

Upat injection system UPM 44 masonry	**Annex C 6**
Performances Solid sand-lime block Species of brick, installation parameters	

Deutsches Institut für Bautechnik DIBt

Kind of masonry: Solid sand-lime block

Table C13: Characteristic values of resistance; tension load (N_{Rk})

Use category		w/w		d/d	
Temperature range [°C]		50/80	72/120	50/80	72/120
Effective anchorage depth	Anchor size	characteristic values N_{Rk} [kN]			
Compressive strength f_b = 10 N/mm²					
≥50	M6	3,00	2,50	5,00	4,50
85	UPM-I M6				
≥50	M8	4,00	3,50	7,00	5,50
	M10 / M12	4,50	3,50	7,00	5,50
85	M16 UPM-I M8 UPM-I M10 / M12	3,50	3,00	5,50	4,50
Perforated sleeve 16x85	UPM-I M6	3,00	2,50	5,00	4,50
	M8 / M10 /UPM-I M8	4,50	3,50	8,00	6,50
Compressive strength f_b = 20 N/mm²					
≥50	M6	4,50	3,50	7,50	6,50
85	UPM-I M6				
≥50	M8	6,00	5,00	10,00 (9,0)[1]	8,00
	M10 / M12	6,00	5,00	10,00 (9,0)[1]	8,00
85	M16 UPM-I M8 UPM-I M10 / M12	5,00	4,00	7,50	6,50
Perforated sleeve 16x85	UPM-I M6	4,50	3,50	7,50	6,50
	M8 / M10 /UPM-I M8	6,50	5,00	11,00 (9,0)[1]	9,00
Compressive strength f_b = 28 N/mm²					
≥50	M6	5,00	4,00	8,50	8,50
85	UPM-I M6				
≥50	M8	8,00	7,00	12,00 (9,0)[1]	8,00
	M10 / M12	8,50	7,00	12,00 (9,0)[1]	11,50 (9,0)
85	M16 UPM-I M8 UPM-I M10 / M12	7,00	6,00	11,00 (9,0)[1]	9,00
Perforated sleeve 16x85	UPM-I M6	5,00	4,00	8,50	8,50
	M8 / M10 /UPM-I M8	8,50	7,00	12,00 (9,0)[1]	12,00 (9,0)[1]

[1] Characteristic value of pulling out of one brick $N_{Rk,pb}$ = 9,0 kN

Table C14: Characteristic values of resistance; shear load (V_{Rk})

Compressive strength [N/mm²]		10	20	28
Effective anchorage depth	Anchor size	characteristic values V_{Rk} [kN]		
≥ 50	M6	2,5	4,0	5,0
85	UPM-I M6			
≥ 50	M8 / M10 / M12 /M16,	4,5	6,5	9,0
85	UPM-I M8 UPM-I M10 / M12			
Perforated sleeve 16x85	UPM-I M6	2,5	4,0	5,0
	M8 / M10 / UPM-I M8	4,5	6,5	9,0

Factor for job site tests and displacements see Annex C78.

Upat injection system UPM 44 masonry	
Performances Solid sand-lime block Characteristic values	**Annex C 7**

Deutsches Institut für Bautechnik DIBt

Kind of masonry: Light-weight concrete block Vbl

Table C15: Parameters of brick

Species of brick		Light-weight concrete block Vbl
Density	$\rho \geq$ [kg/dm^3]	0,6
Compressive strength	$f_b \geq$ [N/mm^2]	2
Standard or approval		EN 771-3
Producer		e.g. Sepa
Size, dimensions	[mm]	≥ 372x300x254
Minimum thickness of brick	h_{min} [mm]	300

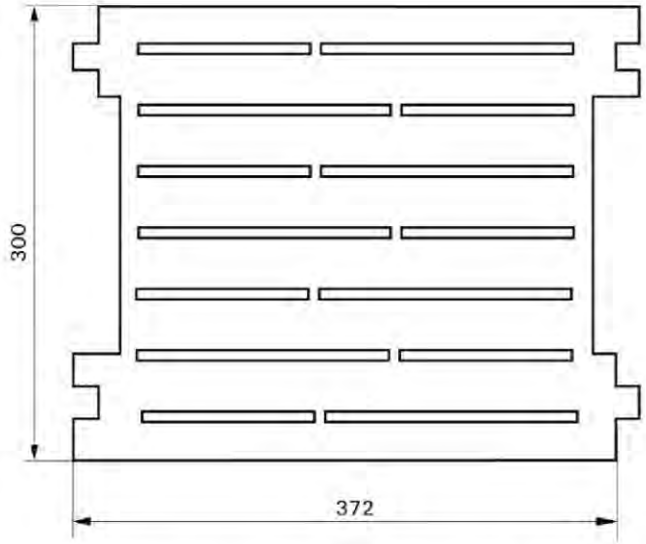

Table C16: Installation parameters for threaded rod with perforated sleeve

Size of perforated sleeve		16x130		18x130/200		20x130		22x130/200	20x200	
Size of threaded rod		M8	M10	M10	M12	M12	M16	M16	M12	M16
Edge distance	c_{min} [mm]	130								
Spacing	s_{cr} II = s_{min} II [mm]	370								
	$s_{cr}\perp$ = $s_{min}\perp$ [mm]	250								
Group-factor	$\alpha_{g,N}$ II [-]	2,0								
	$\alpha_{g,V}$ II [-]									
	$\alpha_{g,N}\perp$ [-]									
	$\alpha_{g,V}\perp$ [-]									
Max. installation torque	$T_{inst,max}$ [Nm]	4								

Upat injection system UPM 44 masonry	**Annex C 8**
Performances Solid light-weight concrete block Vbl Species of brick, installation parameters	

Deutsches Institut für Bautechnik DIBt

Kind of masonry: Solid light-weight concrete block Vbl

Table C17: Characteristic values of resistance; tension load (N_{Rk})

Use category		w/w		d/d	
Temperature range [°C]		50/80	72/120	50/80	72/120
Sleeve/anchor combinations	Sleeve/anchor combinations	characteristic values N_{Rk} [kN]			
Compressive strength f_b = 2 N/mm²					
16x130 / M8 / M10	18x130/200 / M10 / M12	2,00	1,50	2,00	2,00
20x130 / M12 / M16	22x130/200 / M16	2,50	2,50	3,00	2,50
20x200 / M12 / M16		3,50	3,00	4,00	3,00

Table C18: Characteristic values of resistance; shear load (V_{Rk})

Use category		w/w		d/d	
Temperature range [°C]		50/80	72/120	50/80	72/120
Sleeve/anchor combinations	Sleeve/anchor combinations	characteristic values V_{Rk} [kN]			
Compressive strength f_b = 2 N/mm²					
16x130 / M8 / M10	18x130/200 / M10 / M12	4,50			
20x130 / M12 / M16					
20x200 / M12 / M16	22x130/200 / M16	6,50			

Factor for job site tests and displacements see Annex C78.

Upat injection system UPM 44 masonry	
Performances Solid light-weight concrete block Vbl Characteristic values	**Annex C 9**

Deutsches Institut für Bautechnik DIBt

Kind of masonry: Solid light-weight concrete block Vbl

Table C19: Parameters of brick

Species of brick		Solid light-weight concrete block Vbl
Density	$\rho \geq$ [kg/dm^3]	1,6
Compressive strength	$f_b \geq$ [N/mm^2]	4, 6 or 8
Standard or approval		EN 771-3
Producer		KLB
Size, dimensions	[mm]	≥ 250x240x239
Minimum thickness of brick	h_{min} [mm]	240

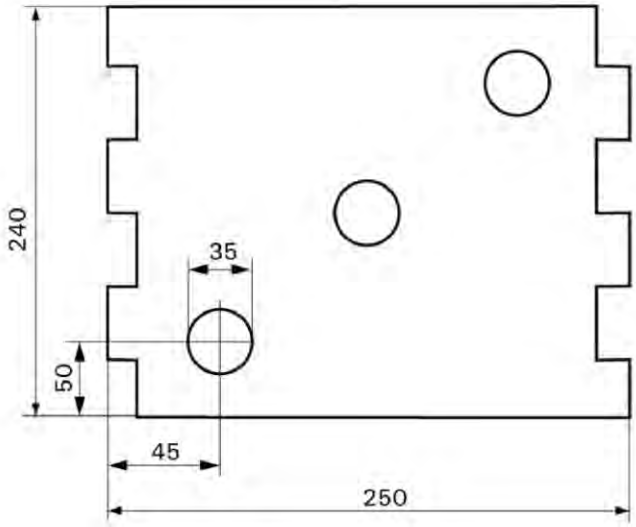

Table C20: Installation parameters for threaded rod with perforated sleeve and internal threaded anchor UPM-I with perforated sleeve

Size of perforated sleeve		12x50		12x85		16x85		16x130		18x130/200		20x85		20x130		22x130/200		20x200	
Size of threaded rod		M6	M8	M6	M8	M8	M10	M8	M10	M10	M12	M12	M16	M12	M16	M16		M12	M16
Size of internal threaded anchor UPM-I						M6/M8						M10/M12							
Edge distance	c_{min} [mm]	130																	
Spacing	s_{cr} II = s_{min} II	250																	
	s_{cr} ⊥ = s_{min} ⊥	250																	
Group-factor	$\alpha_{g,N}$ II [-]	2,0																	
	$\alpha_{g,V}$ II [-]																		
	$\alpha_{g,N}$ ⊥ [-]																		
	$\alpha_{g,V}$ ⊥ [-]																		
Max. installation torque	$T_{inst,max}$ [Nm]	4																	

Upat injection system UPM 44 masonry	
Performances Solid light-weight concrete block Vbl Species of brick, installation parameters	**Annex C 10**

Kind of masonry: Solid light-weight concrete block Vbl

Table C21: Characteristic values of resistance; tension load (N_{Rk})

Use category		w/w		d/d	
Temperature range [°C]		50/80	72/120	50/80	72/120
Sleeve/anchor combinations	Sleeve/anchor combinations	characteristic values N_{Rk} [kN]			
Compressive strength f_b = 4 N/mm²					
12x50 M6 / M8		1,20	0,90	2,00	1,50
12x85 M6 / M8		2,00	1,50	3,50	3,00
16x85 M8 / M10 16x85 UPM-I M6 / M8	16x130 M8 / M10 18x130/200 M10 / M12	2,50	2,00	4,00	3,50
20x85 M12 / M16 20x85 UPM-I M10 / M12	20x130 M12 / M16 20x200 M12 / M16 22x130/200 M16	3,00	2,50	5,00	4,50
Compressive strength f_b = 6 N/mm²					
12x50 M6 / M8		1,50	1,50	3,00	2,50
12x85 M6 / M8		3,00	2,50	5,00	4,00
16x85 M8 / M10 16x85 UPM-I M6 / M8	16x130 M8 / M10 18x130/200 M10 / M12	4,00	3,00	6,50	5,50
20x85 M12 / M16 20x85 UPM-I M10 / M12	20x130 M12 / M16 20x200 M12 / M16 22x130/200 M16	5,00	4,00	7,50	6,50
Compressive strength f_b = 8 N/mm²					
12x50 M6 / M8		2,00	2,00	4,00	3,00
12x85 M6 / M8		4,00	3,00	7,00	5,50
16x85 M8 / M10 16x85 UPM-I M6 / M8	16x130 M8 / M10 18x130/200 M10 / M12	5,00	4,00	8,50	7,00
20x85 M12 / M16 20x85 UPM-I M10 / M12	20x130 M12 / M16 20x200 M12 / M16 22x130/200 M16	6,50	5,50	9,00	8,50

Factor for job site tests and displacements see Annex C78.

Upat injection system UPM 44 masonry	**Annex C 11**
Performances Solid light-weight concrete block Vbl Characteristic values tension load	

Deutsches Institut für Bautechnik DIBt

Kind of masonry: Solid light-weight concrete block Vbl

Table C22: Characteristic values of resistance; shear load (V_{Rk})

Use category		w/w		d/d	
Temperature range [°C]		50/80	72/120	50/80	72/120
Sleeve/anchor combinations	Sleeve/anchor combinations	characteristic values V_{Rk} [kN]			
Compressive strength f_b = 4 N/mm²					
12x50 M6 12x85 M6	16x85 / UPM-I M6	2,00			
12x50 M8	12x85 M8	3,00			
16x85 M8 / M10 UPM-I M8	16x130 M8 / M10 18x130/200 M10 / M12	3,50			
20x85 M12 / M16 UPM-I M10 / M12	20x130 M12 / M16 20x200 M12 / M16 22x130/200 M16	4,50			
Compressive strength f_b = 6 N/mm²					
12x50 M6 12x85 M6	16x85 / UPM-I M6	3,00			
12x50 M8	12x85 M8	4,50			
16x85 M8 / M10 UPM-I M8	16x130 M8 / M10 18x130/200 M10 / M12	5,50			
20x85 M12 / M16 UPM-I M10 / M12	20x130 M12 / M16 20x200 M12 / M16 22x130/200 M16	6,50			
Compressive strength f_b = 8 N/mm²					
12x50 M6 12x85 M6	16x85 / UPM-I M6	4,00			
12x50 M8	12x85 M8	6,00			
16x85 M8 / M10 UPM-I M8	16x130 M8 / M10 18x130/200 M10 / M12	7,00			
20x85 M12 / M16 UPM-I M10 / M12	20x130 M12 / M16 20x200 M12 / M16 22x130/200 M16	8,50			

Factor for job site tests and displacements see Annex C78.

Upat injection system UPM 44 masonry	**Annex C 12**
Performances Solid light-weight concrete block Vbl Characteristic values shear load	

Deutsches Institut für Bautechnik DIBt

Kind of masonry: Perforated block form B, HLz

Table C23: Parameters of brick

Species of brick		Perforated block form B, HLz
Density	$\rho \geq$ [kg/dm^3]	1,0
Compressive strength	$f_b \geq$ [N/mm^2]	4, 6, 8, 10 or 12
Standard or approval		EN 771-1
Producer		e.g. Wienerberger, Poroton
Size, dimensions	[mm]	500(370)x175(240)x237
Minimum thickness of brick	h_{min} [mm]	175(240)

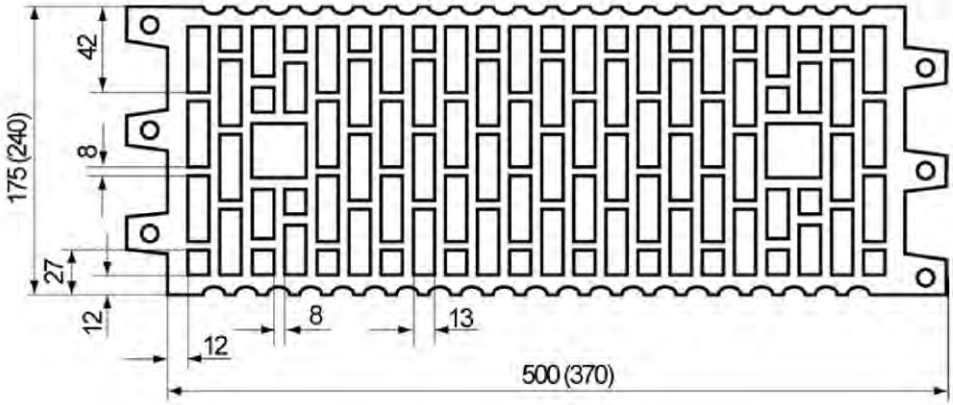

Table C24: Installation parameters for threaded rod with perforated sleeve and internal threaded anchor UPM-I with perforated sleeve

Size of perforated sleeve		12x50		12x85		16x85		16x130		20x85		20x130	
Size of threaded rod		M6	M8	M6	M8	M8	M10	M8	M10	M12	M16	M12	M16
Size of internal threaded anchor UPM-I						M6/M8				M10/M12			
Edge distance	c_{min} [mm]	100											
Spacing	s_{min} II [mm]	100											
	s_{cr} II [mm]	500 (370)											
	s_{min} ⊥ [mm]	100											
	s_{cr} ⊥ [mm]	240											
Group-factor	$\alpha_{g,N}$ II [-]	1											
	$\alpha_{g,V}$ II [-]												
	$\alpha_{g,N}$ ⊥ [-]												
	$\alpha_{g,V}$ ⊥ [-]												
Max. installation torque	$T_{inst,max}$ [Nm]	2											

Upat injection system UPM 44 masonry	**Annex C 13**
Performances Perforated block form B,HLz Species of brick, installation parameters	

Deutsches Institut für Bautechnik DIBt

Kind of masonry: Perforated block form B, HLz

Table C25: Characteristic values of resistance; tension load (N_{Rk})

Use category		w/w		d/d	
Temperature range [°C]		50/80	72/120	50/80	72/120
Sleeve/anchor combinations	Sleeve/anchor combinations	characteristic values N_{Rk} [kN]			
Compressive strength f_b = **4 N/mm²**					
12x50 M6/M8	12x85 M6/M8	0,30	-	0,40	0,30
16x85 M8 / M10	20x85 M12 / M16	0,90	0,75	0,90	0,90
16x85 UPM-I M6 / M8	20x 85 UPM-I M10 / M12				
16x130 M8/ M10					
20x130 M12/M16		1,20	0,90	1,20	1,20
Compressive strength f_b = **6 N/mm²**					
12x50 M6/M8	12x85 M6/M8	0,50	0,40	0,60	0,50
16x85 M8 / M10	20x85 M12 / M16	1,50	1,20	1,50	1,20
16x85 UPM-I M6 / M8	20x 85 UPM-I M10 / M12				
16x130 M8/ M10					
20x130 M12/M16		2,0	1,5	2,0	1,5
Compressive strength f_b = **8 N/mm²**					
12x50 M6/M8	12x85 M6/M8	0,75	0,60	0,75	0,60
16x85 M8 / M10	20x85 M12 / M16	2,00	1,50	2,00	1,50
16x85 UPM-I M6 / M8	20x 85 UPM-I M10 / M12				
16x130 M8/ M10					
20x130 M12/M16		2,50	2,00	2,50	2,00
Compressive strength f_b = **10 N/mm²**					
12x50 M6/M8	12x85 M6/M8	0,90	0,75	0,90	0,75
16x85 M8 / M10	20x85 M12 / M16	2,50	2,00	2,50	2,00
16x85 UPM-I M6 / M8	20x 85 UPM-I M10 / M12				
16x130 M8/ M10					
20x130 M12/M16		3,00	2,50	3,50	3,00
Compressive strength f_b = **12 N/mm²**					
12x50 M6/M8	12x85 M6/M8	0,90	0,90	1,20	0,90
16x85 M8 / M10	20x85 M12 / M16	3,00	2,50	3,00	2,50
16x85 UPM-I M6 / M8	20x 85 UPM-I M10 / M12				
16x130 M8/ M10					
20x130 M12/M16		3,50	3,00	4,00	3,50

Factor for job site tests and displacements see Annex C78.

Upat injection system UPM 44 masonry	**Annex C 14**
Performances Perforated block form B, HLz Characteristic values tension load	

Deutsches Institut für Bautechnik DIBt

Kind of masonry: Perforated block form B, HLz

Table C26: Characteristic values of resistance; shear load (V_{Rk})

Use category		w/w		d/d	
Temperature range [°C]		50/80	72/120	50/80	72/120
Sleeve/anchor combinations	Sleeve/anchor combinations	characteristic values N_{Rk} [kN]			
Compressive strength f_b = 4 N/mm²					
12x50 M6/M8	12x85 M6 / M8	0,50			
16x85 M8 / M10	20x85 M12 / M16				
16x85 UPM-I M6 / M8	20x 85 UPM-I M10 / M12				
16x130 M8/M10	20x130 M12/M16	0,60			
Compressive strength f_b = 6 N/mm²					
12x50 M6/M8	12x85 M6 / M8	0,75			
16x85 M8 / M10	20x85 M12 / M16				
16x85 UPM-I M6 / M8	20x 85 UPM-I M10 / M12				
16x130 M8/M10	20x130 M12/M16	0,90			
Compressive strength f_b = 8 N/mm²					
12x50 M6/M8	12x85 M6 / M8	0,90			
16x85 M8 / M10	20x85 M12 / M16				
16x85 UPM-I M6 / M8	20x 85 UPM-I M10 / M12				
16x130 M8/M10	20x130 M12/M16	1,20			
Compressive strength f_b = 10 N/mm²					
12x50 M6/M8	12x85 M6 / M8	1,20			
16x85 M8 / M10	20x85 M12 / M16				
16x85 UPM-I M6 / M8	20x 85 UPM-I M10 / M12				
16x130 M8/M10	20x130 M12/M16	1,50			
Compressive strength f_b = 12 N/mm²					
12x50 M6/M8	12x85 M6 / M8	1,5			
16x85 M8 / M10	20x85 M12 / M16				
16x85 UPM-I M6 / M8	20x 85 UPM-I M10 / M12				
16x130 M8/M10	20x130 M12/M16	2,00			

Factor for job site tests and displacements see Annex C78.

Upat injection system UPM 44 masonry	**Annex C 15**
Performances Perforated block form B, HLz Characteristic values shear load	

Deutsches Institut für Bautechnik DIBt

Kind of masonry: Perforated brick HLz, 2DF

Table C27: Parameters of brick

Species of brick		Perforated brick HLz
Density	$\rho \geq$ [kg/dm^3]	1,4
Compressive strength	$f_b \geq$ [N/mm^2]	6, 10, 16, 20 or 28
Standard or approval		EN 771-1
Producer		e.g. Wienerberger
Size, dimensions	[mm]	240x115x113
Minimum thickness of brick	h_{min} [mm]	115

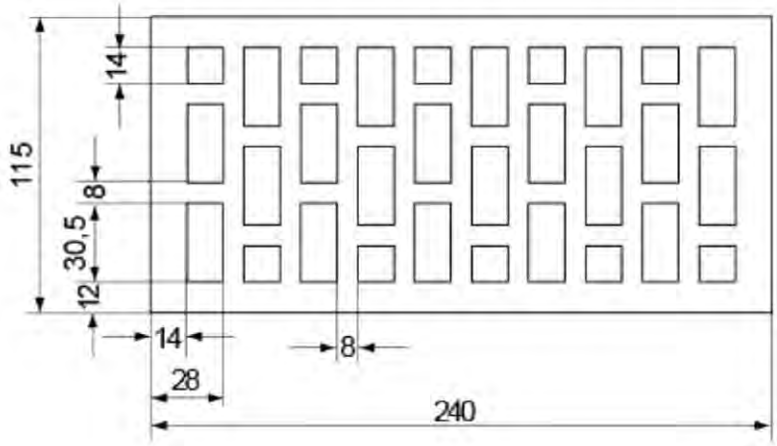

Table C28: Installation parameters for threaded rod with perforated sleeves and internal threaded anchor UPM-I with perforated sleeve

Size of perforated sleeve		12x50		12x85		16x85		20x85	
Size of threaded rod		M6	M8	M6	M8	M8	M10	M12	M16
Size of internal threaded anchor UPM-I						M6/M8		M10/M12	
Edge distance	c_{min} [mm]	80							
Spacing	s_{cr} II = s_{min} II [mm]	240							
	$s_{cr}\perp$ = $s_{min}\perp$ [mm]	115							
Group-factor	$\alpha_{g,N}$ II [-]	2,0							
	$\alpha_{g,V}$ II [-]								
	$\alpha_{g,N}\perp$ [-]								
	$\alpha_{g,V}\perp$ [-]								
Max. installation torque	$T_{inst,max}$ [Nm]	2							

Upat injection system UPM 44 masonry	**Annex C 16**
Performances Perforated brick HLz, 2DF Species of brick, installation parameters	

Deutsches Institut für Bautechnik DIBt

Kind of masonry: Perforated brick HLz, 2DF

Table C29: Characteristic values of resistance; tension load (N_{Rk})

Use category		w/w		d/d	
Temperature range [°C]		50/80	72/120	50/80	72/120
Sleeve/anchor combinations	Sleeve/anchor combinations	characteristic values N_{Rk} [kN]			
Compressive strength f_b = 6 N/mm²					
12x50 M6 / M8		0,75	0,60	0,75	0,60
12x85 M6 / M8		0,90	0,90	1,20	0,90
16x85 M8 / M10	16x85 UPM-I M6 / M8	0,75	0,60	0,75	0,60
20x85 M12 / M16	20x85 UPM-I M10 / M12	0,90	0,75	0,90	0,75
Compressive strength f_b = 10 N/mm²					
12x50 M6 / M8		1,20	0,90	1,20	0,90
12x85 M6 / M8		1,50	1,50	2,00	1,50
16x85 M8 / M10	16x85 UPM-I M6 / M8	1,20	0,90	1,20	1,20
20x85 M12 / M16	20x85 UPM-I M10 / M12	1,50	1,20	1,50	1,20
Compressive strength f_b = 16 N/mm²					
12x50 M6 / M8		2,00	1,50	2,00	1,50
12x85 M6 / M8		2,50	2,00	3,00	2,50
16x85 M8 / M10	16x85 UPM-I M6 / M8	2,00	1,50	2,00	1,50
20x85 M12 / M16	20x85 UPM-I M10 / M12	2,00	2,00	2,50	2,00
Compressive strength f_b = 20 N/mm²					
12x50 M6 / M8		2,50	2,00	2,50	2,00
12x85 M6 / M8		3,50	3,00	4,00	3,00
16x85 M8 / M10	16x85 UPM-I M6 / M8	2,50	2,00	2,50	2,00
20x85 M12 / M16	20x85 UPM-I M10 / M12	3,00	2,50	3,00	2,50
Compressive strength f_b = 28 N/mm²					
12x50 M6 / M8		3,00	2,50	3,50	3,00
12x85 M6 / M8		5,00	4,00	5,50	4,50
16x85 M8 / M10	16x85 UPM-I M6 / M8	3,50	3,00	3,50	3,00
20x85 M12 / M16	20x85 UPM-I M10 / M12	4,00	3,50	4,50	3,50

Factor for job site tests and displacements see Annex C78.

Upat injection system UPM 44 masonry	**Annex C 17**
Performances Perforated brick HLz Characteristic values tension load	

Deutsches Institut für Bautechnik DIBt

Kind of masonry: Perforated brick, HLz, 2DF

Table C30: Characteristic values of resistance; shear load (V_{Rk})

Use category		w/w		d/d	
Temperature range [°C]		50/80	72/120	50/80	72/120
Sleeve/anchor combinations	Sleeve/anchor combinations	characteristic values V_{Rk} [kN]			
Compressive strength f_b = **6 N/mm²**					
12x50 M6 12x85 M6	16x85 UPM-I M6	1,2			
12x85 M8		2,0			
16x85 M8 / M10 12x50 M8	16x85 UPM-I M8	1,5			
20x85 M12 / M16	20x85 UPM-I M10 / M12	2,5			
Compressive strength f_b = **10 N/mm²**					
12x50 M6 12x85 M6	16x85 UPM-I M6	2,0			
12x85 M8		4,0			
16x85 M8 / M10 12x50 M8	16x85 UPM-I M8	2,5			
20x85 M12 / M16	20x85 UPM-I M10 / M12	4,5			
Compressive strength f_b = **16 N/mm²**					
12x50 M6 12x85 M6	16x85 UPM-I M6	3,0			
12x85 M8		6,0 (5,5)[1)]			
16x85 M8 / M10 12x50 M8	16x85 UPM-I M8	3,5			
20x85 M12 / M16	20x85 UPM-I M10 / M12	7,0 (5,5)[1)]			
Compressive strength f_b = **20 N/mm²**					
12x50 M6 12x85 M6	16x85 UPM-I M6	4,0			
12x85 M8		7,5 (5,5)[1)]			
16x85 M8 / M10 12x50 M8	16x85 UPM-I M8	4,5			
20x85 M12 / M16	20x85 UPM-I M10 / M12	8,5 (5,5)[1)]			
Compressive strength f_b = **28 N/mm²**					
12x50 M6 12x85 M6	16x85 UPM-I M6	5,0			
12x85 M8		9,5 (5,5)[1)]			
16x85 M8 / M10 12x50 M8	16x85 UPM-I M8	6,5 (5,5)[1)]			
20x85 M12 / M16	20x85 UPM-I M10 / M12	12,0 (5,5)[1)]			

[1)] Characteristic value of pushing out of one brick $V_{Rk,pb}$ = 5,5 kN

Factor for job site tests and displacements see Annex C78.

Upat injection system UPM 44 masonry	**Annex C 18**
Performances Perforated brick HLz Characteristic values shear load	

Deutsches Institut für Bautechnik DIBt

Kind of masonry: Sand-lime hollow brick KSL

Table C31: Parameters of brick

Species of brick		Sand-lime hollow brick KSL
Density	$\rho \geq$ [kg/dm^3]	1,4
Compressive strength	$f_b \geq$ [N/mm^2]	8, 10, 12, 16 or 20
Standard or approval		EN 771-2
Producer		e.g. KS Wemding
Size, dimensions	[mm]	240x175x113
Minimum thickness of brick	h_{min} [mm]	175

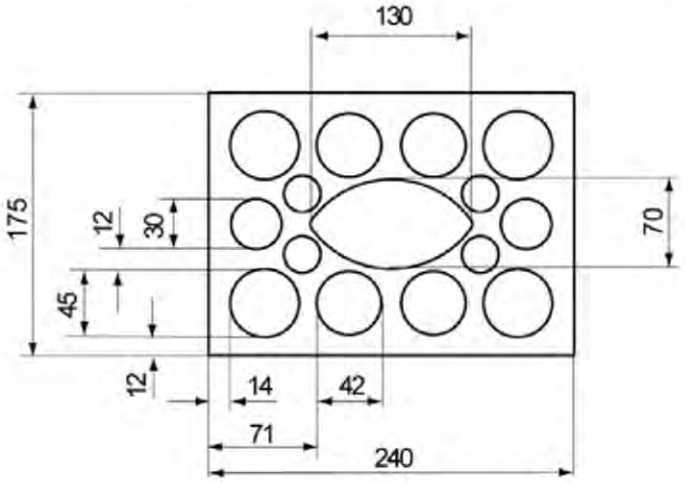

Table C32: Installation parameters for threaded rod with perforated sleeve and internal threaded anchor UPM-I with perforated sleeve

Size of perforated sleeve		12x50		12x85		16x85		16x130		18x130/200		20x85		20x130		22x130/200
Size of threaded rod		M6	M8	M6	M8	M8	M10	M8	M10	M10	M12	M12	M16	M12	M16	M16
Size of internal threaded anchor UPM-I						M6/M8						M10/M12				
Edge distance	c_{min} [mm]	60				80										
Spacing	s_{min} ∥ [mm]	100														
	s_{cr} ∥ [mm]	240														
	s_{cr} ⊥ = s_{min} ⊥ [mm]	115														
Group-factor	$\alpha_{g,N}$ ∥ [-]	1,5														
	$\alpha_{g,V}$ ∥ [-]															
	$\alpha_{g,N}$ ⊥ [-]	2,0														
	$\alpha_{g,V}$ ⊥ [-]															
Max. installation torque	$T_{inst,max}$ [Nm]	2														

Upat injection system UPM 44 masonry	**Annex C 19**
Performances Sand-lime hollow brick KSL Species of brick, installation parameters	

Deutsches Institut für Bautechnik DIBt

Kind of masonry: Sand-lime hollow brick KSL

Table C33: Characteristic values of resistance; tension load (N_{Rk})

Use category		w/w		d/d	
Temperature range [°C]		50/80	72/120	50/80	72/120
Sleeve/anchor combinations	Sleeve/anchor combinations	characteristic values N_{Rk} [kN]			
Compressive strength f_b = **8 N/mm²**					
12x50 M6 / M8	12x85 M6 / M8	1,50	1,20	1,50	1,50
16x85 M8 / M10	UPM-I M6 / M8	2,00	1,50	2,00	1,50
16x130 M8 / M10 18x 130 /200 M10 / M12 20x85 UPM-I M10 / M12	20x130 M12 / M16 22x130/200 M16	2,00	1,50	2,50	2,00
Compressive strength f_b = **10 N/mm²**					
12x50 M6 / M8	12x85 M6 / M8	2,00	1,50	2,00	2,00
16x85 M8 / M10	UPM-I M6 / M8	2,00	2,00	2,50	2,50
16x130 M8 / M10 18x 130 /200 M10 / M12 20x85 UPM-I M10 / M12	20x130 M12 / M16 22x130/200 M16	2,50	2,00	3,00	2,50
Compressive strength f_b = **12 N/mm²**					
12x50 M6 / M8	12x85 M6 / M8	2,50	2,00	2,50	2,00
16x85 M8 / M10	UPM-I M6 / M8	2,50	2,00	3,00	2,50
16x130 M8 / M10 18x 130 /200 M10 / M12 20x85 UPM-I M10 / M12	20x130 M12 / M16 22x130/200 M16	3,00	2,50	3,50	3,00
Compressive strength f_b = **16 N/mm²**					
12x50 M6 / M8	12x85 M6 / M8	3,00	2,50	3,50	3,00
16x85 M8 / M10	UPM-I M6 / M8	3,50	3,00	4,00	3,50
16x130 M8 / M10 18x 130 /200 M10 / M12 20x85 UPM-I M10 / M12	20x130 M12 / M16 22x130/200 M16	4,50	3,50	4,50	4,00
Compressive strength f_b = **20 N/mm²**					
12x50 M6 / M8	12x85 M6 / M8	4,00	3,50	4,50	3,50
16x85 M8 / M10	UPM-I M6 / M8	4,50	4,00	5,00	4,00
16x130 M8 / M10 18x 130 /200 M10 / M12 20x85 UPM-I M10 / M12	20x130 M12 / M16 22x130/200 M16	5,50	4,50	6,00	5,00

Factor for job site tests and displacements see Annex C78.

Upat injection system UPM 44 masonry	**Annex C 20**
Performances Sand-lime hollow brick KSL Characteristic values tension load	

Deutsches Institut für Bautechnik DIBt

Kind of masonry: Sand-lime hollow brick KSL

Table C34: Characteristic values of resistance; shear load (V_{Rk})

Use category		w/w		d/d	
Temperature range [°C]		50/80	72/120	50/80	72/120
Sleeve/anchor combinations	Sleeve/anchor combinations	characteristic values V_{Rk} [kN]			
Compressive strength f_b = 8 N/mm²					
12x50 M6 / 12x85 M6	16x85 UPM-I M6	1,50			
12x50 M8 / 12x85 M8		1,50			
16x85 M8 / M10 16x85 UPM-I M8 16x130 M10 / M12	18x130/200 M10 / M12 20x85 M12 20x85 UPM-I M10 / M12 20x130 M12	3,00			
20x85 M16 20x130 M16	22x130/200 M16	2,50			
Compressive strength f_b = 10 N/mm²					
12x50 M6 / 12x85 M6	16x85 UPM-I M6	2,00			
12x50 M8 / 12x85 M8		2,00			
16x85 M8 / M10 16x85 UPM-I M8 16x130 M10 / M12	18x130/200 M10 / M12 20x85 M12 20x85 UPM-I M10 / M12 20x130 M12	3,50			
20x85 M16 20x130 M16	22x130/200 M16	3,50			
Compressive strength f_b = 12 N/mm²					
12x50 M6 / 12x85 M6	16x85 UPM-I M6	2,50			
12x50 M8 / 12x85 M8		2,50			
16x85 M8 / M10 16x85 UPM-I M8 16x130 M10 / M12	18x130/200 M10 / M12 20x85 M12 20x85 UPM-I M10 / M12 20x130 M12	4,50			
20x85 M16 20x130 M16	22x130/200 M16	4,00			
Compressive strength f_b = 16 N/mm²					
12x50 M6 / 12x85 M6	16x85 UPM-I M6	3,00			
12x50 M8 / 12x85 M8		3,50			
16x85 M8 / M10 16x85 UPM-I M8 16x130 M10 / M12	18x130/200 M10 / M12 20x85 M12 20x85 UPM-I M10 / M12 20x130 M12	6,00			
20x85 M16 20x130 M16	22x130/200 M16	5,50			
Compressive strength f_b = 20 N/mm²					
12x50 M6 / 12x85 M6	16x85 UPM-I M6	4,00			
12x50 M8 / 12x85 M8		4,50			
16x85 M8 / M10 16x85 UPM-I M8 16x130 M10 / M12	18x130/200 M10 / M12 20x85 M12 20x85 UPM-I M10 / M12 20x130 M12	7,50			
20x85 M16 20x130 M16	22x130/200 M16	6,50			

Factor for job site tests and displacements see Annex C78.

Upat injection system UPM 44 masonry	**Annex C 21**
Performances Sand-lime hollow brick KSL Characteristic values shear load	

Deutsches Institut für Bautechnik DIBt

Kind of masonry: Light-weight concrete hollow block Hbl

Table C35: Parameters of brick

Species of brick		Light-weight concrete hollow block Hbl
Density	$\rho \geq$ [kg/dm^3]	1,0
Compressive strength	$f_b \geq$ [N/mm^2]	2 or 4
Standard or approval		EN 771-3
Producer		
Size, dimensions	[mm]	362x240x240
Minimum thickness of brick	h_{min} [mm]	240

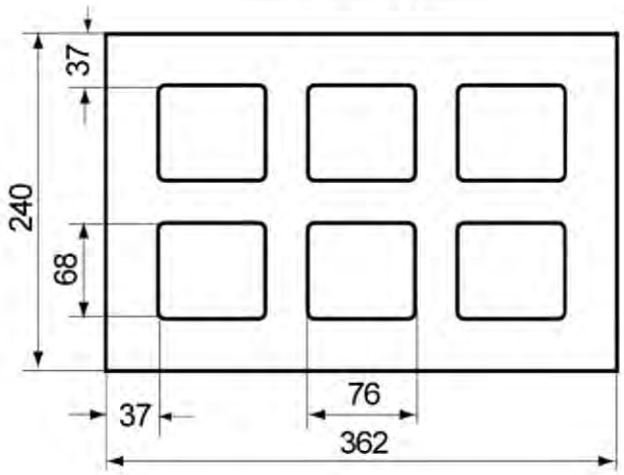

Table C36: Installation parameters for threaded rod with perforated sleeve and internal threaded anchor UPM-I with perforated sleeve

Size of perforated sleeve		12x50		12x85		16x85		16x130		18x130/200		20x85		20x130		22x130/200	20x200	
Size of threaded rod		M6	M8	M6	M8	M8	M10	M8	M10	M10	M12	M12	M16	M12	M16	M16	M12	M16
Size of internal threaded anchor UPM-I						M6/M8						M10/M12						
Edge distance	c_{min} [mm]	60																
Spacing	s_{min} II [mm]	100																
	s_{cr} II [mm]	362																
	$s_{cr}^{\perp} = s_{min}^{\perp}$ [mm]	240																
Group-factor	$\alpha_{g,N}$ II [-]	1,2																
	$\alpha_{g,V}$ II [-]	1,1																
	$\alpha_{g,N}^{\perp}$ [-]	2,0																
	$\alpha_{g,V}^{\perp}$ [-]																	
Max. installation torque	$T_{inst,max}$ [Nm]	2																

Upat injection system UPM 44 masonry	**Annex C 22**
Performances Light-weight concrete hollow block Hbl Species of brick, installation parameters	

Deutsches Institut für Bautechnik DIBt

Kind of masonry: Light-weight concrete hollow block Hbl

Table C37: Characteristic values of resistance; tension load (N_{Rk})

Use category		w/w		d/d	
Temperature range [°C]		50/80	72/120	50/80	72/120
Sleeve/anchor combinations	Sleeve/anchor combinations	characteristic values N_{Rk} [kN]			
Compressive strength f_b = 2 N/mm²					
12x50 M6 / M8		1,20	0,90	1,20	0,90
12x85 M6 16x130 M8 / M10	18x130/200 M10 / M12	1,50	1,20	1,50	1,20
16x85 M8 / M10 16x85 / UPM-I M6 / M8	20x85 M12 / M16 20x85 / UPM-I M10 / M12 20x130 M12 / M16 22x130/200 M16	1,50	1,20	1,50	1,20
20x200 M12 / M16		2,50	2,00	2,50	2,00
Compressive strength f_b = 4 N/mm²					
12x50 M6 / M8		2,00	2,00	2,50	2,00
12x85 M6 16x130 M8 / M10	18x130/200 M10 / M12	3,00	2,50	3,00	2,50
16x85 M8 / M10 16x85 / UPM-I M6 / M8	20x85 M12 / M16 20x85 / UPM-I M10 / M12 20x130 M12 / M16 22x130/200 M16	3,00	2,50	3,00	2,50
20x200 M12 / M16		5,00	4,00	5,50	4,50

Factor for job site tests and displacements see Annex C78.

Upat injection system UPM 44 masonry	
Performances Light-weight concrete hollow block Hbl Characteristic values tension load	**Annex C 23**

Deutsches Institut für Bautechnik DIBt

Kind of masonry: Light-weight concrete hollow block Hbl

Table C38: Characteristic values of resistance; shear load (V_{Rk})

Use category		w/w		d/d	
Temperature range [°C]		50/80	72/120	50/80	72/120
Sleeve/anchor combinations	Sleeve/anchor combinations	characteristic values V_{Rk} [kN]			
Compressive strength f_b = 2 N/mm²					
All sizes		0,90			
Compressive strength f_b = 4 N/mm²					
All sizes		2,00			

Factor for job site tests and displacements see Annex C78.

Upat injection system UPM 44 masonry	
Performances Light-weight concrete hollow block Hbl Characteristic values shear load	**Annex C 24**

Deutsches Institut für Bautechnik DIBt

Kind of masonry: Perforated block form B, HLz

Table C39: Parameters of brick

Species of brick		Perforated block form B, HLz
Density	$\rho \geq$ [kg/dm^3]	0,6
Compressive strength	$f_b \geq$ [N/mm^2]	4, 6, 8
Standard or approval		EN 771-1
Producer		e.g. Bouyer Leroux
Size, dimensions	[mm]	500x200x315
Minimum thickness of brick	h_{min} [mm]	200

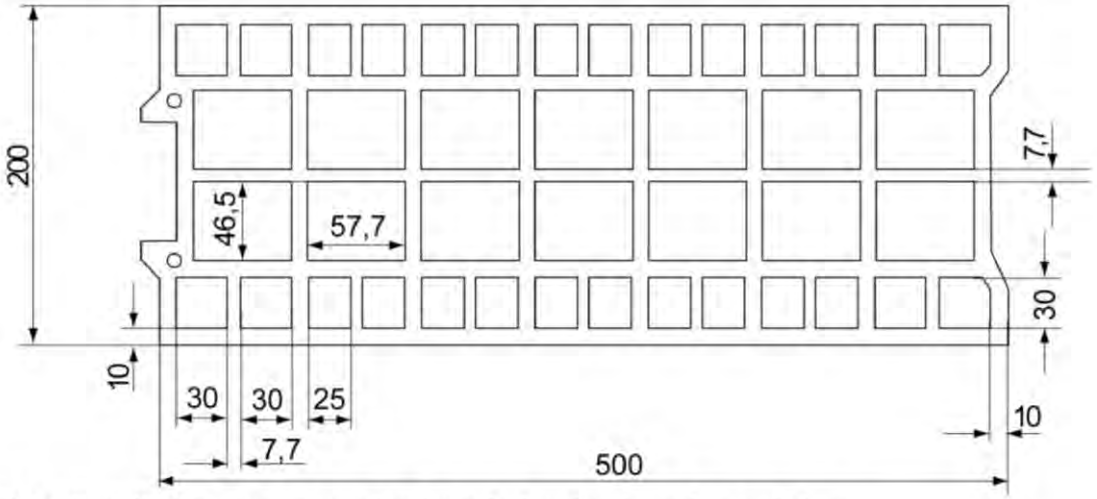

Table C40: Installation parameters for threaded rod with perforated sleeve and internal threaded anchor UPM-I with perforated sleeve

Size of perforated sleeve		12x50		12x85		16x85		16x130		18x130/200		20x85		20x130		22x130/200
Size of threaded rod		M6	M8	M6	M8	M8	M10	M8	M10	M10	M12	M12	M16	M12	M16	M16
Size of internal threaded anchor UPM-I						M6/M8						M10/M12				
Edge distance	c_{min} [mm]	120														
Spacing	s_{min} ∥ [mm]	120														
	s_{cr} ∥ [mm]	500														
	$s_{cr}^{\perp}=s_{min}^{\perp}$ [mm]	315														
Group-factor	$\alpha_{g,N}$ ∥ [-]	1,3														
	$\alpha_{g,V}$ ∥ [-]	1,7														
	$\alpha_{g,N}^{\perp}$ [-]	2,0														
	$\alpha_{g,V}^{\perp}$ [-]															
Max. installation torque	$T_{inst,max}$ [Nm]	2														

Upat injection system UPM 44 masonry	**Annex C 25**
Performances Perforated block form B, HLz Species of brick, installation parameters	

Deutsches Institut für Bautechnik DIBt

Kind of masonry: Perforated block form B, HLz

Table C41: Characteristic values of resistance; tension load (N_{Rk})

Use category		w/w		d/d	
Temperature range [°C]		50/80	72/120	50/80	72/120
Sleeve/anchor combinations	Sleeve/anchor combinations	characteristic values N_{Rk} [kN]			
Compressive strength f_b = 4 N/mm²					
12x50 M6 / M8		0,50	0,40	0,60	0,50
12x85 M6 / M8 16x85 M8 / M10 16x85 / UPM-I M6 / M8	20x85 M12 / M16 20x85 / UPM-I M10 / M12	1,50	1,20	1,50	1,20
16x130 M8 / M10 18x130/200 M8 / M10		0,75	0,60	0,90	0,75
20x130 M16 22x130/200 M16		1,50	1,20	2,00	1,50
Compressive strength f_b = 6 N/mm²					
12x50 M6 / M8		0,75	0,60	0,90	0,75
12x85 M6 / M8 16x85 M8 / M10 16x85 / UPM-I M6 / M8	20x85 M12 / M16 20x85 / UPM-I M10 / M12	2,00	2,00	2,50	2,00
16x130 M8 / M10 18x130/200 M8 / M10		1,20	0,90	1,20	1,20
20x130 M12 / M16 22x130/200 M16		2,50	2,00	2,50	2,00
Compressive strength f_b = 8 N/mm²					
12x50 M6 / M8		0,90	0,90	1,20	0,90
12x85 M6 / M8 16x85 M8 / M10 16x85 / UPM-I M6 / M8	20x85 M12 / M16 20x85 / UPM-I M10 / M12	3,00	2,50	3,00	2,50
16x130 M8 / M10 18x130/200 M8 / M10		1,50	1,20	2,00	1,50
20x130 M12 / M16 22x130/200 M16		3,50	2,50	3,50	3,00

Factor for job site tests and displacements see Annex C78.

Upat injection system UPM 44 masonry	**Annex C 26**
Performances Perforated block form B, HLz Characteristic values tension load	

Deutsches Institut für Bautechnik DIBt

Kind of masonry: Perforated block form B, HLz

Table C42: Characteristic values of resistance; shear load (V_{Rk})

Use category		w/w		d/d	
Temperature range [°C]		50/80	72/120	50/80	72/120
Sleeve/anchor combinations	Sleeve/anchor combinations	characteristic values V_{Rk} [kN]			
Compressive strength f_b = 4 N/mm²					
12x50 M6 / M8 12x85 M6 / M8 16x85 M8 / M10	16x85 / UPM-I M6 / M8 20x85 / UPM-I M10/M12 20x85 M12	1,50			
20x85 M16		2,50			
16x130 M8 / M10 20x130 M12 / M16	18x130/200 M10 / M12 22x130/200 M16	0,90			
Compressive strength f_b = 6 N/mm²					
12x50 M6 / M8 12x85 M6 / M8 16x85 M8 / M10	16x85 / UPM-I M6 / M8 20x85 / UPM-I M10/M12 20x85 M12	2,50			
20x85 M16		3,50			
16x130 M8 / M10 20x130 M12 / M16	18x130/200 M10 / M12 22x130/200 M16	1,50			
Compressive strength f_b = 8 N/mm²					
12x50 M6 / M8 12x85 M6 / M8 16x85 M8 / M10	16x85 / UPM-I M6 / M8 20x85 / UPM-I M10/M12 20x85 M12	3,50			
20x85 M16		4,50			
16x130 M8 / M10 20x130 M12 / M16	18x130/200 M10 / M12 22x130/200 M16	2,00			

Factor for job site tests and displacements see Annex C78.

Upat injection system UPM 44 masonry	
Performances Perforated block form B, HLz Characteristic values shear load	**Annex C27**

Deutsches Institut für Bautechnik DIBt

Kind of masonry: Perforated block form B, HLz

Table C43: Parameters of brick

Species of brick		Perforated block form B, HLz
Density	$\rho \geq$ [kg/dm^3]	0,7
Compressive strength	$f_b \geq$ [N/mm^2]	4, 6, 8 or 10
Standard or approval		EN 771-1
Producer		e.g. Wienerberger
Size, dimensions	[mm]	500x200x300
Minimum thickness of brick	h_{min} [mm]	200

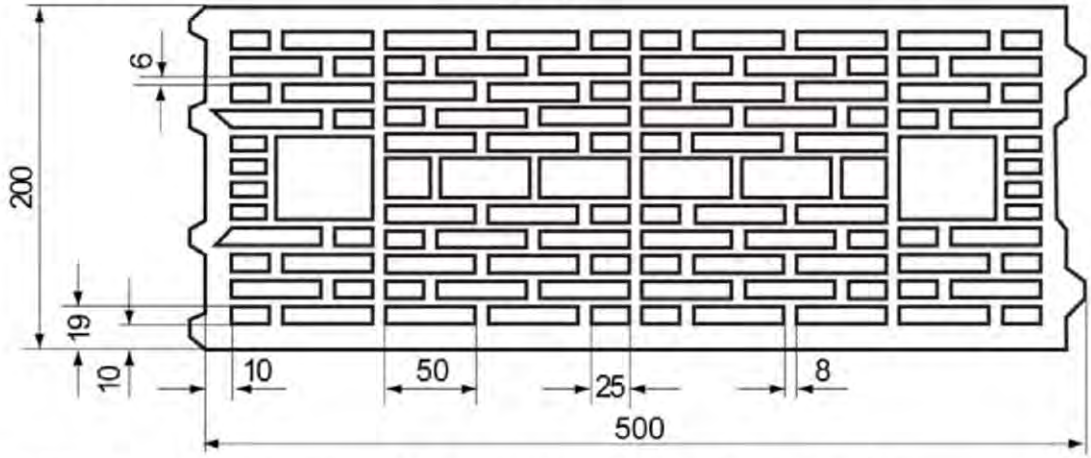

Table C44: Installation parameters for threaded rod with perforated sleeve and internal threaded anchor UPM-I with perforated sleeve

Size of perforated sleeve		12x50		12x85		16x85		16x130		18x130/200		20x85		20x130		22x130/200
Size of threaded rod		M6	M8	M6	M8	M8	M10	M8	M10	M10	M12	M12	M16	M12	M16	M16
Size of internal threaded anchor UPM-I						M6/M8						M10/M12				
Edge distance	c_{min} [mm]	50						80				50		80		
Spacing	s_{min} II [mm]	100														
	s_{cr} II [mm]	500														
	$s_{cr}\perp = s_{min}\perp$ [mm]	300														
Group-factor	$\alpha_{g,N}$ II [-]	1,4														
	$\alpha_{g,V}$ II [-]	2,0														
	$\alpha_{g,N}\perp$ [-]															
	$\alpha_{g,V}\perp$ [-]															
Max. installation torque	$T_{inst,max}$ [Nm]	2														

Upat injection system UPM 44 masonry	**Annex C 28**
Performances Perforated block form B,HLz Species of brick, installation parameters	

Deutsches Institut für Bautechnik DIBt

Kind of masonry: Perforated block form B, HLz

Table C45: Characteristic values of resistance; tension load (N_{Rk})

Use category		w/w		d/d	
Temperature range [°C]		50/80	72/120	50/80	72/120
Sleeve/anchor combinations	Sleeve/anchor combinations	characteristic values N_{Rk} [kN]			
Compressive strength f_b = 4 N/mm²					
12x50 M6 / M8	12x85 M6 / M8	0,50	0,40	0,60	0,50
16x85 M8 / M10	16x85 / UPM-I M6 / M8	0,60	0,50	0,75	0,60
20x85 M12 / M16	20x85 / UPM-I M10 / M12	0,75	0,60	0,90	0,75
16x130 M8 / M10	18x130/200 M10 / M12	1,20	0,90	1,20	0,90
20x130 M12 / M16	22x130/200 M16	1,50	1,20	1,50	1,20
Compressive strength f_b = 6 N/mm²					
12x50 M6 / M8	12x85 M6 / M8	0,75	0,60	0,90	0,75
16x85 M8 / M10	16x85 / UPM-I M6 / M8	0,90	0,75	1,20	0,90
20x85 M12 / M16	20x85 / UPM-I M10 / M12	1,20	0,90	1,20	1,20
16x130 M8 / M10	18x130/200 M10 / M12	1,50	1,20	2,00	1,50
20x130 M12 / M16	22x130/200 M16	2,00	1,50	2,50	2,00
Compressive strength f_b = 8 N/mm²					
12x50 M6 / M8	12x85 M6 / M8	0,90	0,90	1,20	0,90
16x85 M8 / M10	16x85 / UPM-I M6 / M8	1,20	1,20	1,50	1,20
20x85 M12 / M16	20x85 / UPM-I M10 / M12	1,50	1,20	1,50	1,50
16x130 M8 / M10	18x130/200 M10 / M12	2,00	2,00	2,50	2,00
20x130 M12 / M16	22x130/200 M16	2,50	2,50	3,00	2,50
Compressive strength f_b = 10 N/mm²					
12x50 M6 / M8	12x85 M6 / M8	1,20	0,90	1,50	1,2
16x85 M8 / M10	16x85 / UPM-I M6 / M8	1,50	1,20	2,00	1,50
20x85 M12 / M16	20x85 / UPM-I M10 / M12	2,00	1,50	2,00	2,00
16x130 M8 / M10	18x130/200 M10 / M12	2,50	2,00	3,00	2,50
20x130 M12 / M16	22x130/200 M16	3,50	3,00	4,00	3,00

Factor for job site tests and displacements see Annex C78.

Upat injection system UPM 44 masonry	
Performances Perforated block form B, HLz Characteristic values tension load	**Annex C 29**

Deutsches Institut für Bautechnik DIBt

Kind of masonry: Perforated block form B, HLz

Table C46: Characteristic values of resistance; shear load (V_{Rk})

Use category		w/w		d/d	
Temperature range [°C]		50/80	72/120	50/80	72/120
Sleeve/anchor combinations	Sleeve/anchor combinations	characteristic values V_{Rk} [kN]			
Compressive strength f_b = 4 N/mm²					
12x50 M6	16x85 / UPM-I M6	0,90			
12x50 M8 12x85 M6 / M8	16x85 / UPM-I M8	1,20			
20x85 M12 / M16	20x85 /UPM-I M10 / M12	2,00			
16x130 M8 / M10 18x130/200 M10 / M12	20x130 M12 / M16 22x130/200 M16	0,60			
Compressive strength f_b = 6 N/mm²					
12x50 M6	16x85 / UPM-I M6	1,20			
12x50 M8 12x85 M6 / M8	16x85 / UPM-I M8	1,50			
20x85 M12 / M16	20x85 /UPM-I M10 / M12	3,00			
16x130 M8 / M10 18x130/200 M10 / M12	20x130 M12 / M16 22x130/200 M16	0,90			
Compressive strength f_b = 8 N/mm²					
12x50 M6	16x85 / UPM-I M6	1,50			
12x50 M8 12x85 M6 / M8	16x85 / UPM-I M8	2,00			
20x85 M12 / M16	20x85 /UPM-I M10 / M12	4,00			
16x130 M8 / M10 18x130/200 M10 / M12	20x130 M12 / M16 22x130/200 M16	1,20			
Compressive strength f_b = 10 N/mm²					
12x50 M6	16x85 / UPM-I M6	2,00			
12x50 M8 12x85 M6 / M8	16x85 / UPM-I M8	3,00			
20x85 M12 / M16	20x85 /UPM-I M10 / M12	5,00			
16x130 M8 / M10 18x130/200 M10 / M12	20x130 M12 / M16 22x130/200 M16	1,50			

Factor for job site tests and displacements see Annex C78.

Upat injection system UPM 44 masonry	**Annex C 30**
Performances Perforated block form B, HLz Characteristic values shear load	

Deutsches Institut für Bautechnik DIBt

Kind of masonry: Perforated block form B, HLz

Table C47: Parameters of brick

Species of brick		Perforated block form B, HLz
Density	$\rho \geq$ [kg/dm^3]	0,7
Compressive strength	$f_b \geq$ [N/mm^2]	2, 4, 6 or 8
Standard or approval		EN 771-1
Producer		e.g. Terreal
Size, dimensions	[mm]	500x200x315
Minimum thickness of brick	h_{min} [mm]	200

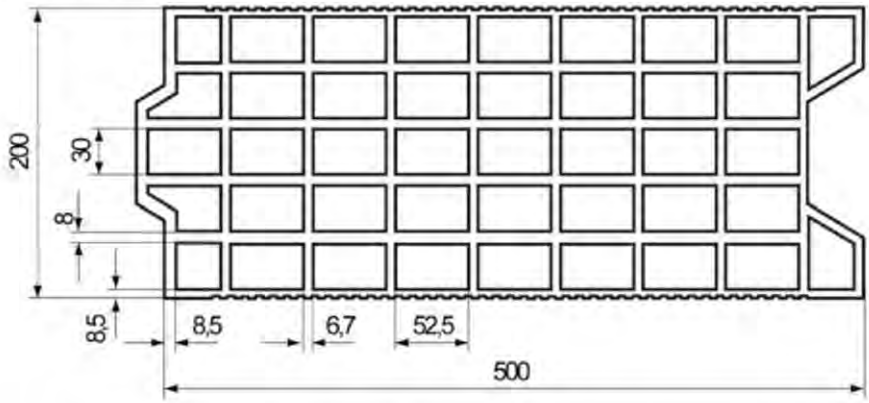

Table C48: Installation parameters for threaded rod with perforated sleeve and internal threaded anchor UPM-I with perforated sleeve

Size of perforated sleeve		12x50		12x85		16x85		16x130		18x130/200		20x85		20x130		22x130/200
Size of threaded rod		M6	M8	M6	M8	M8	M10	M8	M10	M10	M12	M12	M16	M12	M16	M16
Size of internal threaded anchor UPM-I						M6/M8						M10/M12				
Edge distance	c_{min} [mm]	50						80				50		80		
Spacing	s_{min} II [mm]	100														
	s_{cr} II [mm]	500														
	$s_{min} \perp$ [mm]	100														
	$s_{cr} \perp$ [mm]	315														
Group-factor	$\alpha_{g,N}$ II [-]	1,1														
	$\alpha_{g,V}$ II [-]	1,2														
	$\alpha_{g,N} \perp$ [-]	1,1														
	$\alpha_{g,V} \perp$ [-]	1,2														
Max. installation torque	$T_{inst,max}$ [Nm]	2														

Upat injection system UPM 44 masonry	**Annex C 31**
Performances Perforated block form B, HLz Species of brick, installation parameters	

Deutsches Institut für Bautechnik DIBt

Kind of masonry: Perforated block form B, HLz

Table C49: Characteristic values of resistance; tension load (N_{Rk})

Use category		w/w		d/d	
Temperature range [°C]		50/80	72/120	50/80	72/120
Sleeve/anchor combinations	Sleeve/anchor combinations	characteristic values N_{Rk} [kN]			
Compressive strength f_b = 2 N/mm²					
12x50 M6 / M8		0,50	0,40	0,50	0,40
12x85 M6 / M8	16x85 M8 / M10 16x85 / UPM-I M6 / M8 20x85 M12 / M16 20x85 /UPM-I M10 / M12	0,50	0,40	0,50	0,40
20x130 M12 / M16 22x130/200 M16	16x130 M8 / M10 18x130/200 M10 / M12	0,50	0,40	0,60	0,50
Compressive strength f_b = 4 N/mm²					
12x50 M6 / M8		0,90	0,75	0,90	0,90
12x85 M6 / M8	16x85 M8 / M10 16x85 / UPM-I M6 / M8 20x85 M12 / M16 20x85 /UPM-I M10 / M12	0,90	0,75	1,20	0,90
20x130 M12 / M16 22x130/200 M16	16x130 M8 / M10 18x130/200 M10 / M12	0,90	0,90	1,20	0,90
Compressive strength f_b = 6 N/mm²					
12x50 M6 / M8		1,50	1,20	1,50	1,20
12x85 M6 / M8	16x85 M8 / M10 16x85 / UPM-I M6 / M8 20x85 M12 / M16 20x85 /UPM-I M10 / M12	1,50	1,20	1,50	1,20
20x130 M12 / M16 22x130/200 M16	16x130 M8 / M10 18x130/200 M10 / M12	1,50	1,20	1,50	1,50
Compressive strength f_b = 8 N/mm²					
12x50 M6 / M8		2,00	1,50	2,00	1,50
12x85 M6 / M8	16x85 M8 / M10 16x85 / UPM-I M6 / M8 20x85 M12 / M16 20x85 /UPM-I M10 / M12M12	2,00	1,50	2,00	2,00
20x130 M12 / M16 22x130/200 M16	16x130 M8 / M10 18x130/200 M10 / M12	2,00	1,50	2,00	2,00

Factor for job site tests and displacements see Annex C78.

Upat injection system UPM 44 masonry	**Annex C 32**
Performances Perforated block form B, HLz Characteristic values tension load	

Deutsches Institut für Bautechnik DIBt

Kind of masonry: Perforated block form B, HLz

Table C50: Characteristic values of resistance; shear load (V_{Rk})

Use category		w/w		d/d	
Temperature range [°C]		50/80	72/120	50/80	72/120
Sleeve/anchor combinations	Sleeve/anchor combinations	characteristic values V_{Rk} [kN]			
Compressive strength f_b = **2 N/mm²**					
12x50 M6	16x85 / UPM-I M6	0,30			
12x50 M8 12x85 M6 / M8	16x85 M8 16x85 / UPM-I M8	0,60			
20x85 M12 / M16	20x85 / UPM-I M10 / M12	0,90			
16x130 M8 / M10	18x130/200 M10 / M12	0,60			
20x130 M12 / M16	22x130/200 M16	0,75			
Compressive strength f_b = **4 N/mm²**					
12x50 M6	16x85 / UPM-I M6	0,75			
12x50 M8 12x85 M6 / M8	16x85 M8 16x85 / UPM-I M8	1,20			
20x85 M12 / M16	20x85 / UPM-I M10 / M12	2,00			
16x130 M8 / M10	18x130/200 M10 / M12	1,20			
20x130 M12 / M16	22x130/200 M16	1,50			
Compressive strength f_b = **6 N/mm²**					
12x50 M6	16x85 / UPM-I M6	0,90			
12x50 M8 12x85 M6 / M8	16x85 M8 16x85 / UPM-I M8	2,00			
20x85 M12 / M16	20x85 / UPM-I M10 / M12	3,00			
16x130 M8 / M10	18x130/200 M10 / M12	1,50			
20x130 M12 / M16	22x130/200 M16	2,00			
Compressive strength f_b = **8 N/mm²**					
12x50 M6	16x85 / UPM-I M6	1,50			
12x50 M8 12x85 M6 / M8	16x85 M8 16x85 / UPM-I M8	2,50			
20x85 M12 / M16	20x85 / UPM-I M10 / M12	4,00			
16x130 M8 / M10	18x130/200 M10 / M12	2,00			
20x130 M12 / M16	22x130/200 M16	3,00			

Factor for job site tests and displacements see Annex C78.

Upat injection system UPM 44 masonry	**Annex C 33**
Performances Perforated block form B, HLz Characteristic values shear load	

Deutsches Institut für Bautechnik DIBt

Kind of masonry: Perforated block form B, HLz

Table C51: Parameters of brick

Species of brick		Perforated block form B, HLz
Density	$\rho \geq$ [kg/dm^3]	0,7
Compressive strength	$f_b \geq$ [N/mm^2]	4, 6 or 8
Standard or approval		EN 771-1
Producer		e.g. Imery
Size, dimensions	[mm]	500x200x275
Minimum thickness of brick	h_{min} [mm]	200

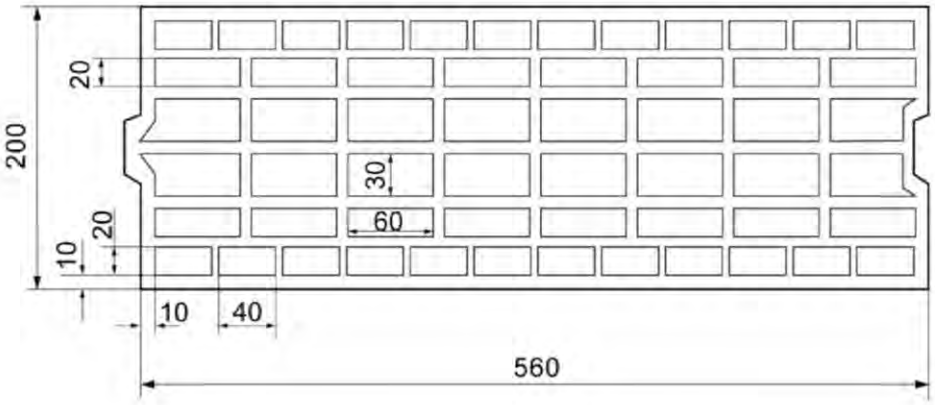

Table C52: Installation parameters for threaded rod with perforated sleeve

Size of perforated sleeve		16x130		18x130/200		20x130		22x130/200
Size of threaded rod		M8	M10	M10	M12	M12	M16	M16
Edge distance	c_{min} [mm]	80						
Spacing	s_{cr} II = s_{min} II [mm]	560						
	s_{cr} ⊥ = s_{min} ⊥ [mm]	275						
Group-factor	$\alpha_{g,N}$ II [-]	2,0						
	$\alpha_{g,V}$ II [-]							
	$\alpha_{g,N}$ ⊥ [-]							
	$\alpha_{g,V}$ ⊥ [-]							
Max. installation torque	$T_{inst,max}$ [Nm]	2						

Upat injection system UPM 44 masonry	
Performances Perforated block form B, HLz Species of brick, installation parameters	**Annex C 34**

Deutsches Institut für Bautechnik DIBt

Kind of masonry: Perforated block form B, HLz

Table C53: Characteristic values of resistance; tension load (N_{Rk})

Use category		w/w		d/d	
Temperature range [°C]		50/80	72/120	50/80	72/120
Sleeve/anchor combinations	Sleeve/anchor combinations	characteristic values N_{Rk} [kN]			
Compressive strength f_b = 4 N/mm²					
16x130 M8 / M10	18x130/200 M10 / M12	0,90	0,90	1,20	0,90
20x130 M12 / M16	22x130/200 M16	1,20	1,20	1,50	1,20
Compressive strength f_b = 6 N/mm²					
16x130 M8 / M10	18x130/200 M10 / M12	1,50	1,20	1,50	1,50
20x130 M12 / M16	22x130/200 M16	2,00	1,50	2,00	2,00
Compressive strength f_b = 8 N/mm²					
16x130 M8 / M10	18x130/200 M10 / M12	2,00	1,50	2,50	2,00
20x130 M12 / M16	22x130/200 M16	2,50	2,00	3,00	2,50

Table C54: Characteristic values of resistance; shear load (V_{Rk})

Use category		w/w		d/d	
Temperature range [°C]		50/80	72/120	50/80	72/120
Sleeve/anchor combinations	Sleeve/anchor combinations	characteristic values V_{Rk} [kN]			
Compressive strength f_b = 4 N/mm²					
16x130 M8 / M10 18x130/200 M10 / M12	20x130 M12 / M16 22x130/200 M16	0,90			
Compressive strength f_b = 6 N/mm²					
16x130 M8 / M10 18x130/200 M10 / M12	20x130 M12 / M16 22x130/200 M16	1,50			
Compressive strength f_b = 8 N/mm²					
16x130 M8 / M10 18x130/200 M10 / M12	20x130 M12 / M16 22x130/200 M16	2,00			

Factor for job site tests and displacements see Annex C78.

Upat injection system UPM 44 masonry	**Annex C 35**
Performances Perforated block form B,HLz Characteristic values	

Deutsches Institut für Bautechnik DIBt

Kind of masonry: Light-weight concrete hollow block Hbl

Table C55: Parameters of brick

Species of brick		Light-weight concrete hollow block Hbl
Density	$\rho \geq$ [kg/dm^3]	1,0
Compressive strength	$f_b \geq$ [N/mm^2]	2, 4 or 6
Standard or approval		EN 771-1
Producer		e.g. Sepa
Size, dimensions	[mm]	500x200x200
Minimum thickness of brick	h_{min} [mm]	200

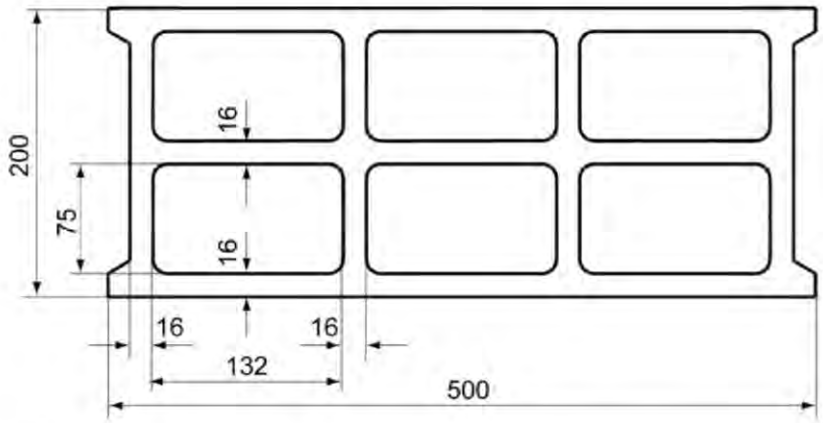

Table C56: Installation parameters for threaded rod with perforated sleeve

Size of perforated sleeve		12x50		12x85		16x85		16x130		18x130/200		20x85	
Size of threaded rod		M6	M8	M6	M8	M8	M10	M8	M10	M10	M12	M12	M16
Size of internal threaded anchor UPM-I						M6/M8						M10/M12	
Edge distance	c_{min} [mm]	100											
Spacing	s_{cr} II = s_{min} II [mm]	500											
	s_{cr} ⊥ = s_{min} ⊥ [mm	200											
Group-factor	$\alpha_{g,N}$ II [-]	2,0											
	$\alpha_{g,V}$ II [-]												
	$\alpha_{g,N}$ ⊥ [-]												
	$\alpha_{g,V}$ ⊥ [-]												
Max. installation torque	$T_{inst,max}$ [Nm]	1				2							

Upat injection system UPM 44 masonry	**Annex C 36**
Performances Light-weight concrete hollow block Species of brick, installation parameters	

Deutsches Institut für Bautechnik DIBt

Kind of masonry: Light-weight concrete hollow block Hbl

Table C57: Characteristic values of resistance; tension load (N_{Rk})

Use category		w/w		d/d	
Temperature range	[°C]	50/80	72/120	50/80	72/120
Sleeve/anchor combinations		characteristic values N_{Rk} [kN]			
Compressive strength f_b = 2 N/mm²					
All sizes		0,40	0,40	0,50	0,40
Compressive strength f_b = 4 N/mm²					
All sizes		0,90	0,75	0,90	0,75
Compressive strength f_b = 6N/mm²					
All sizes		1,20	1,20	1,50	1,20

Table C58: Characteristic values of resistance; shear load (V_{Rk})

Use category		w/w		d/d	
Temperature range	[°C]	50/80	72/120	50/80	72/120
Sleeve/anchor combinations		characteristic values V_{Rk} [kN]			
Compressive strength f_b = 2 N/mm²					
All sizes		0,90			
Compressive strength f_b = 4 N/mm²					
All sizes		1,50			
Compressive strength f_b = 6 N/mm²					
All sizes		2,50			

Factor for job site tests and displacements see Annex C78.

Upat injection system UPM 44 masonry	
Performances Light-weight concrete hollow block Hbl Characteristic values	**Annex C 37**

Deutsches Institut für Bautechnik DIBt

Kind of masonry: Solid brick Mz

Table C59: Parameters of brick

Species of brick		Solid brick Mz
Density	$\rho \geq$ [kg/dm^3]	1,8
Compressive strength	$f_b \geq$ [N/mm^2]	10 or 20
Standard or approval		EN 771-1
Producer		e.g. Nigra
Size, dimensions	[mm]	≥ 245x118x54
Minimum thickness of brick	h_{min} [mm]	118

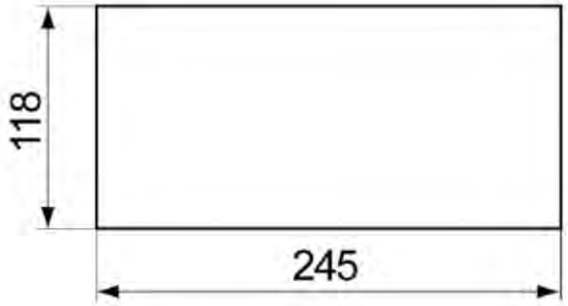

Table C60: Installation parameters for threaded rod and internal threaded anchor without perforated sleeve

Size of threaded rod		M6		M8		M10		M12		M16		UPM-I[1)] M6/M8	UPM-I M10/M12
Effective anchorage depth	h_{ef} [mm]	50	100	50	100	50	100	50	100	50	100	85	85
Edge distance	c_{min} [mm]	60											
Spacing	s_{cr} II = s_{min} II [mm]	245											
	s_{cr} ⊥ = s_{min} ⊥ [mm]	60											
Group-factor	$\alpha_{g,N}$ II [-]	2,0											
	$\alpha_{g,V}$ II [-]												
	$\alpha_{g,N}$ ⊥ [-]												
	$\alpha_{g,V}$ ⊥ [-]												
Max. installation torque	$T_{inst,max}$ [Nm]	4		10									

[1)] For UPM-I with screw M6: $T_{inst,max}$= 4 Nm

Upat injection system UPM 44 masonry	
Performances Solid brick Mz Species of brick, installation parameters	**Annex C 38**

Deutsches Institut für Bautechnik DIBt

Kind of masonry: Solid brick Mz

Table C61: Characteristic values of resistance; tension load (N_{Rk})

Use category		w/w		d/d	
Temperature range [°C]		50/80	72/120	50/80	72/120
Effective anchorage depth	Anchor size	characteristic values N_{Rk} [kN]			
Compressive strength f_b = 10 N/mm²					
≥ 50	M6	0,60	0,50	1,20	0,9
85	UPM-I M6				
≥ 50	M8	0,90	0,90	1,50	1,50
85	UPM-I M8	0,75	0,60	1,20	1,20
≥ 50	M10 / M12 / M16				
85	UPM-I M10 / M12				
Compressive strength f_b = 20 N/mm²					
≥ 50	M6	0,90	0,75	1,50	1,20
85	UPM-I M6				
≥ 50	M8	1,50	1,20	2,50	2,00
85	UPM-I M8	1,20	0,90	2,00	1,50
≥ 50	M10 / M12 / M16				
85	UPM-I M10 / M12				

Table C62: Characteristic values of resistance; shear load (V_{Rk})

Use category		w/w		d/d	
Temperature range [°C]		50/80	72/120	50/80	72/120
Effective anchorage depth	Anchor size	characteristic values V_{Rk} [kN]			
Compressive strength f_b = 10 N/mm²					
≥ 50	M6	2,00			
85	UPM-I M6				
≥ 50	M8	3,00			
85	UPM-I M8				
≥ 50	M10	4,00			
85	UPM-I M10				
≥ 50	M12	4,50			
85	UPM-I M12				
≥ 50	M16	5,50			
Compressive strength f_b = 20 N/mm²					
≥ 50	M6	2,50			
85	UPM-I M6				
≥ 50	M8	4,00			
85	UPM-I M8				
≥ 50	M10	5,50			
85	UPM-I M10				
≥ 50	M12	6,00 (5,50)[1]			
85	UPM-I M12				
≥ 50	M16	8,00 (5,50)[1]			

[1] Characteristic value pushing out of one brick $V_{Rk,pb}$ = 5,50 kN

Factor for job site tests and displacements see Annex C78

Upat injection system UPM 44 masonry	**Annex C 39**
Performances Solid brick Mz Characteristic values	

Deutsches Institut für Bautechnik DIBt

Kind of masonry: Perforated brick HLz

Table C63: Parameters of brick

Species of brick		Perforated brick HLz
Density	$\rho \geq$ [kg/dm^3]	1,0
Compressive strength	$f_b \geq$ [N/mm^2]	2, 4, 6, 8, 10 or 12
Standard or approval		EN 771-1
Producer		e.g. Wienerberger
Size, dimensions	[mm]	255x120x118
Minimum thickness of brick	h_{min} [mm]	120

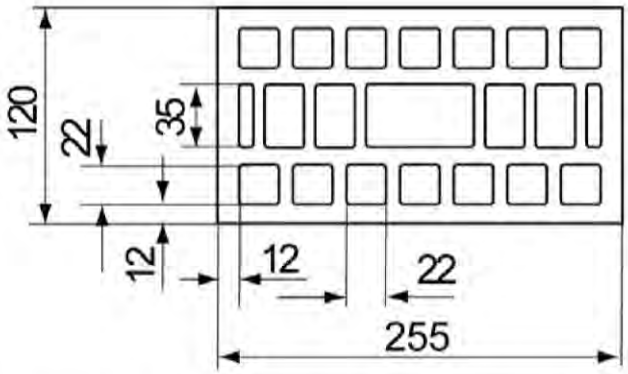

Table C64: Installation parameters for threaded rod with perforated sleeve and internal threaded anchor UPM-I with perforated sleeve

Size of perforated sleeve		12x50		12x85		16x85		20x85	
Size of threaded rod		M6	M8	M6	M8	M8	M10	M12	M16
Size of internal threaded anchor UPM-I						M6/M8		M10/M12	
Edge distance	c_{min} [mm]	60							
Spacing	s_{cr} II = s_{min} II [mm]	255							
	s_{cr} ⊥ = s_{min} ⊥ [mm]	120							
Group-factor	$\alpha_{g,N}$ II [-]	2,0							
	$\alpha_{g,V}$ II [-]								
	$\alpha_{g,N}$ ⊥ [-]								
	$\alpha_{g,V}$ ⊥ [-]								
Max. installation torque	$T_{inst,max}$ [Nm]	2							

Upat injection system UPM 44 masonry	
Performances Perforated brick HLz Species of brick, installation parameters	**Annex C 40**

Deutsches Institut für Bautechnik DIBt

Kind of masonry: Perforated brick HLz

Table C65: Characteristic values of resistance; tension load (N_{Rk})

Use category		w/w		d/d	
Temperature range [°C]		50/80	72/120	50/80	72/120
Sleeve/anchor combinations	Sleeve/anchor combinations	characteristic values N_{Rk} [kN]			
Compressive strength f_b = **2 N/mm²**					
12x50 M6 / M8		0,40	0,30	0,50	0,40
12x85 M6 / M8	16x85 M8 / M10 16x85 / UPM-I M6 / M8	0,50	0,40	0,50	0,50
20x85 M12 / M16	20x85 / UPM-I M10 / M12	--	--	--	--
Compressive strength f_b = **4 N/mm²**					
12x50 M6 / M8		0,90	0,75	0,90	0,75
12x85 M6 / M8	16x85 M8 / M10 16x85 / UPM-I M6 / M8	0,90	0,90	1,20	0,90
20x85 M12 / M16	20x85 / UPM-I M10 / M12	0,50	0,40	0,50	0,40
Compressive strength f_b = **6 N/mm²**					
12x50 M6 / M8		1,20	0,90	1,50	1,20
12x85 M6 / M8	16x85 M8 / M10 16x85 / UPM-I M6 / M8	1,50	1,20	1,50	1,50
20x85 M12 / M16	20x85 / UPM-I M10 / M12	0,75	0,60	0,75	0,60
Compressive strength f_b = **8 N/mm²**					
12x50 M6 / M8		1,50	1,50	2,00	1,50
12x85 M6 / M8	16x85 M8 / M10 16x85 / UPM-I M6 / M8	2,00	1,50	2,00	2,00
20x85 M12 / M16	20x85 / UPM-I M10 / M12	0,90	0,75	0,90	0,90
Compressive strength f_b = **10 N/mm²**					
12x50 M6 / M8		2,00	1,50	2,50	2,00
12x85 M6 / M8	16x85 M8 / M10 16x85 / UPM-I M6 / M8	2,50	2,00	2,50	2,50
20x85 M12 / M16	20x85 / UPM-I M10 / M12	1,20	0,90	1,20	1,20
Compressive strength f_b = **12 N/mm²**					
12x50 M6 / M8		2,50	2,00	3,00	2,50
12x85 M6 / M8	16x85 M8 / M10 16x85 / UPM-I M6 / M8	3,00	2,50	3,50	2,50
20x85 M12 / M16	20x85 / UPM-I M10 / M12	1,50	1,20	1,50	1,20

Factor for job site tests and displacements see Annex C78.

Upat injection system UPM 44 masonry	
Performances Perforated brick HLz Characteristic values tension load	**Annex C 41**

Kind of masonry: Perforated brick HLz

Table C66: Characteristic values of resistance; shear load (V_{Rk})

Use category		w/w		d/d	
Temperature range [°C]		50/80	72/120	50/80	72/120
Sleeve/anchor combinations	Sleeve/anchor combinations	characteristic values V_{Rk} [kN]			
Compressive strength f_b = **2 N/mm²**					
12x50 M6	12x85 M6	0,60			
12x50 M8	12x85 M8	0,75			
20x85 M12 / M16 20x85 / UPM-I M10 / M12	16x85 M8 / M10 16x85 / UPM-I M6 / M8	0,90			
Compressive strength f_b = **4 N/mm²**					
12x50 M6	12x85 M6	1,20			
12x50 M8	12x85 M8	1,50			
20x85 M12 / M16 20x85 / UPM-I M10 / M12	16x85 M8 / M10 16x85 / UPM-I M6 / M8	2,00			
Compressive strength f_b = **6 N/mm²**					
12x50 M6	12x85 M6	2,00			
12x50 M8	12x85 M8	2,00			
20x85 M12 / M16 20x85 / UPM-I M10 / M12	16x85 M8 / M10 16x85 / UPM-I M6 / M8	2,50			
Compressive strength f_b = **8 N/mm²**					
12x50 M6	12x85 M6	2,50			
12x50 M8	12x85 M8	3,00			
20x85 M12 / M16 20x85 / UPM-I M10 / M12	16x85 M8 / M10 16x85 / UPM-I M6 / M8	3,50			
Compressive strength f_b = **10 N/mm²**					
12x50 M6	12x85 M6	3,00			
12x50 M8	12x85 M8	3,50			
20x85 M12 / M16 20x85 / UPM-I M10 / M12	16x85 M8 / M10 16x85 / UPM-I M6 / M8	4,50			
Compressive strength f_b = **12 N/mm²**					
12x50 M6	12x85 M6	4,00			
12x50 M8	12x85 M8	4,50			
20x85 M12 / M16 20x85 / UPM-I M10 / M12	16x85 M8 / M10 16x85 / UPM-I M6 / M8	5,50			

Factor for job site tests and displacements see Annex C78.

Upat injection system UPM 44 masonry	
Performances Perforated brick HLz Characteristic values shear load	**Annex C 42**

Deutsches Institut für Bautechnik DIBt

Kind of masonry: Perforated brick LLz

Table C67: Parameters of brick

Species of brick		Perforated brick LLz
Density	$\rho \geq$ [kg/dm^3]	0,7
Compressive strength	$f_b \geq$ [N/mm^2]	2, 4 or 6
Standard or approval		EN 771-1
Producer		
Size, dimensions	[mm]	248x78x248
Minimum thickness of brick	h_{min} [mm]	80

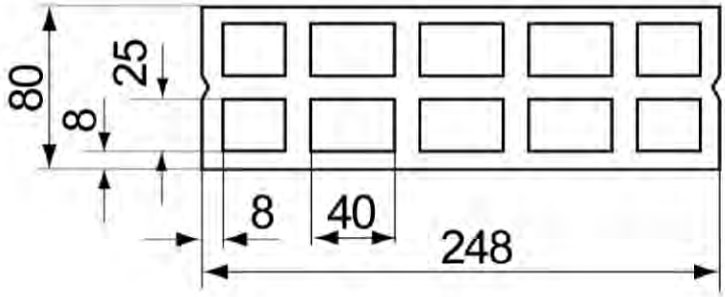

Table C68: Installation parameters for threaded rod with perforated sleeve

Size of perforated sleeve		12x50	
Size of threaded rod		M6	M8
Edge distance	c_{min} [mm]	100	
Spacing	s_{min} II [mm]	75	
	s_{cr} II [mm]	250	
	$s_{cr}\perp = s_{min}\perp$ [mm]	250	
Group-factor	$\alpha_{g,N}$ II [-]	1,6	
	$\alpha_{g,V}$ II [-]	1,1	
	$\alpha_{g,N}\perp$ [-]	2,0	
	$\alpha_{g,V}\perp$ [-]		
Max. installation torque	$T_{inst,max}$ [Nm]	2	

Upat injection system UPM 44 masonry	
Performances Perforated brick LLz Species of brick, installation parameters	**Annex C 43**

Deutsches Institut für Bautechnik DIBt

Kind of masonry: Perforated brick LLz

Table C69: Characteristic values of resistance; tension load (N_{Rk})

Use category		w/w		d/d	
Temperature range [°C]		50/80	72/120	50/80	72/120
Sleeve/anchor combinations	Sleeve/anchor combinations	characteristic values N_{Rk} [kN]			
Compressive strength f_b = 2 N/mm²					
12x50 M6 / M8		0,50	0,40	0,60	0,50
Compressive strength f_b = 4 N/mm²					
12x50 M6 / M8		0,90	0,90	1,20	0,90
Compressive strength f_b = 6 N/mm²					
12x50 M6 / M8		1,50	1,20	1,50	1,50

Table C70: Characteristic values of resistance; shear load (V_{Rk})

Use category		w/w		d/d	
Temperature range [°C]		50/80	72/120	50/80	72/120
Sleeve/anchor combinations	Sleeve/anchor combinations	characteristic values V_{Rk} [kN]			
Compressive strength f_b = 2 N/mm²					
12x50 M6 / M8		0,50			
Compressive strength f_b = 4 N/mm²					
12x50 M6 / M8		0,90			
Compressive strength f_b = 6 N/mm²					
12x50 M6 / M8		1,50			

Factor for job site tests and displacements see Annex C78.

Upat injection system UPM 44 masonry	
Performances Perforated brick LLz Characteristic values	**Annex C 44**

Deutsches Institut für Bautechnik DIBt

Kind of masonry: Perforated brick HLz

Table C71: Parameters of brick

Species of brick		Perforated brick HLz
Density	$\rho \geq$ [kg/dm^3]	0,8
Compressive strength	$f_b \geq$ [N/mm^2]	6, 8, 12, 16 or 20
Standard or approval		EN 771-1
Producer		e.g. Cermanica Farreny S.A.
Size, dimensions	[mm]	275x130x94
Minimum thickness of brick	h_{min} [mm]	130

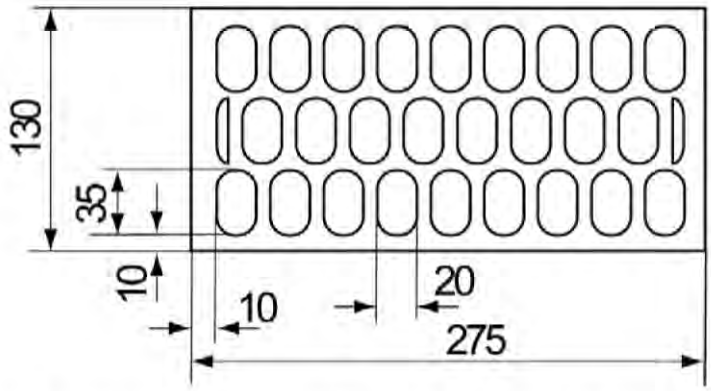

Table C72: Installation parameters for threaded rod with perforated sleeve and internal threaded anchor UPM-I with perforated sleeve

Size of perforated sleeve		12x50		12x85		16x85		20x85	
Size of threaded rod		M6	M8	M6	M8	M8	M10	M12	M16
Size of internal threaded anchor UPM-I						M6/M8		M10/M12	
Edge distance	c_{min} [mm]	100						120	
Spacing	s_{cr} II = s_{min} II [mm]	275							
	$s_{cr}\perp$ = $s_{min}\perp$ [mm]	95							
Group-factor	$\alpha_{g,N}$ II [-]	2,0							
	$\alpha_{g,V}$ II [-]								
	$\alpha_{g,N}\perp$ [-]								
	$\alpha_{g,V}\perp$ [-]								
Max. installation torque	$T_{inst,max}$ [Nm]	2							

Upat injection system UPM 44 masonry	
Performances Perforated brick HLz Species of brick, installation parameters	**Annex C 45**

Deutsches Institut für Bautechnik DIBt

Kind of masonry: Perforated brick HLz

Table C73: Characteristic values of resistance; tension load (N_{Rk})

Use category		w/w		d/d	
Temperature range [°C]		50/80	72/120	50/80	72/120
Sleeve/anchor combinations	Sleeve/anchor combinations	characteristic values N_{Rk} [kN]			
Compressive strength f_b = **6 N/mm²**					
12x50 M6 / M8		0,40	0,30	0,40	0,40
12x85 M6 / M8	16x85 M8 / M10 16x85 / UPM-I M6 / M8 20x85 M12 / M16 20x85 / UPM-I M10 / M12	0,90	0,75	0,90	0,75
Compressive strength f_b = **8 N/mm²**					
12x50 M6 / M8		0,50	0,40	0,60	0,50
12x85 M6 / M8	16x85 M8 / M10 16x85 / UPM-I M6 / M8 20x85 M12 / M16 20x85 / UPM-I M10 / M12	1,20	0,90	1,20	0,90
Compressive strength f_b = **12 N/mm²**					
12x50 M6 / M8		0,75	0,60	0,90	0,75
12x85 M6 / M8	16x85 M8 / M10 16x85 / UPM-I M6 / M8 20x85 M12 / M16 20x85 / UPM-I M10 / M12	1,50	1,50	2,00	1,50
Compressive strength f_b = **16 N/mm²**					
12x50 M6 / M8		0,90	0,90	1,20	0,90
12x85 M6 / M8	16x85 M8 / M10 16x85 / UPM-I M6 / M8 20x85 M12 / M16 20x85 / UPM-I M10 / M12	2,00	2,00	2,50	2,00
Compressive strength f_b = **20 N/mm²**					
12x50 M6 / M8		1,20	1,20	1,50	1,20
12x85 M6 / M8	16x85 M8 / M10 16x85 / UPM-I M6 / M8 20x85 M12 / M16 20x85 / UPM-I M10 / M12	3,00	2,50	3,00	2,50

Factor for job site tests and displacements see Annex C78.

Upat injection system UPM 44 masonry	**Annex C 46**
Performances Perforated brick HLz Characteristic values tension load	

Deutsches Institut für Bautechnik DIBt

Kind of masonry: Perforated brick HLz

Table C74: Characteristic values of resistance; shear load (V_{Rk})

Use category		w/w		d/d	
Temperature range [°C]		50/80	72/120	50/80	72/120
Sleeve/anchor combinations	Sleeve/anchor combinations	characteristic values V_{Rk} [kN]			
Compressive strength f_b = **6 N/mm²**					
12x50 M6 / M8		1,2			
12x85 M6 / M8	16x85 M8 / M10 16x85 / UPM-I M6 / M8 20x85 M12 / M16 20x85 / UPM-I M10 / M12	1,2			
Compressive strength f_b = **8 N/mm²**					
12x50 M6 / M8		1,5			
12x85 M6 / M8	16x85 M8 / M10 16x85 / UPM-I M6 / M8 20x85 M12 / M16 20x85 / UPM-I M10 / M12	1,5			
Compressive strength f_b = **12 N/mm²**					
12x50 M6 / M8		2,0			
12x85 M6 / M8	16x85 M8 / M10 16x85 / UPM-I M6 / M8 20x85 M12 / M16 20x85 / UPM-I M10 / M12	2,5			
Compressive strength f_b = **16 N/mm²**					
12x50 M6 / M8		3,0			
12x85 M6 / M8	16x85 M8 / M10 16x85 / UPM-I M6 / M8 20x85 M12 / M16 20x85 / UPM-I M10 / M12	3,0			
Compressive strength f_b = **20 N/mm²**					
12x50 M6 / M8		4,0			
12x85 M6 / M8	16x85 M8 / M10 16x85 / UPM-I M6 / M8 20x85 M12 / M16 20x85 / UPM-I M10 / M12	4,0			

Factor for job site tests and displacements see Annex C78.

Upat injection system UPM 44 masonry	**Annex C 47**
Performances Perforated brick HLz Characteristic values shear load	

Deutsches Institut für Bautechnik DIBt

Kind of masonry: Perforated brick LLz

Table C75: Parameters of brick

Species of brick		Perforated brick LLz
Density	$\rho \geq$ [kg/dm^3]	0,8
Compressive strength	$f_b \geq$ [N/mm^2]	2
Standard or approval		EN 771-1
Producer		e.g. Cermanica Farreny S.A.
Size, dimensions	[mm]	128x88x275
Minimum thickness of brick	h_{min} [mm]	88

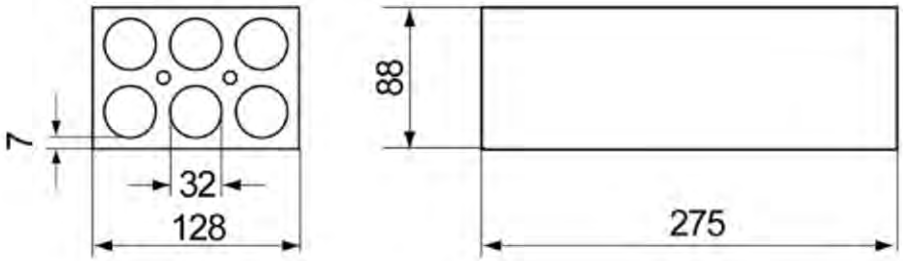

Table C76: Installation parameters for threaded rod with perforated sleeve

Size of perforated sleeve		12x50	
Size of threaded rod		M6	M8
Edge distance	c_{min} [mm]	60	
Spacing	s_{min} II [mm]	75	
	s_{cr} II [mm]	275	
	s_{min} ⊥ [mm]	75	
	s_{cr} ⊥ [mm]	130	
Group-factor	$\alpha_{g,N}$ II [-]	1,3	
	$\alpha_{g,V}$ II [-]	1,5	
	$\alpha_{g,N}$ ⊥ [-]	1,3	
	$\alpha_{g,V}$ ⊥ [-]	1,5	
Max. installation torque	$T_{inst,max}$ [Nm]	2	

Upat injection system UPM 44 masonry	**Annex C 48**
Performances Perforated brick LLz Species of brick, installation parameters	

Deutsches Institut für Bautechnik DIBt

Kind of masonry: Perforated brick LLz

Table C77: Characteristic values of resistance; tension load (N_{Rk})

Use category		w/w		d/d	
Temperature range [°C]		50/80	72/120	50/80	72/120
Sleeve/anchor combinations	Sleeve/anchor combinations	characteristic values N_{Rk} [kN]			
Compressive strength f_b = 2 N/mm²					
12x50 M6 / M8		1,50	1,20	1,50	1,20

Table C78: Characteristic values of resistance; shear load (V_{Rk})

Use category		w/w		d/d	
Temperature range [°C]		50/80	72/120	50/80	72/120
Sleeve/anchor combinations	Sleeve/anchor combinations	characteristic values V_{Rk} [kN]			
Compressive strength f_b = 2 N/mm²					
12x50 M6 / M8		1,20			

Factor for job site tests and displacements see Annex C78.

Upat injection system UPM 44 masonry	
Performances Perforated brick LLz Characteristic values	**Annex C 49**

Deutsches Institut für Bautechnik DIBt

Kind of masonry: Perforated brick HLz

Table C79: Parameters of brick

Species of brick		Perforated brick HLz
Density	$\rho \geq$ [kg/dm^3]	0,7
Compressive strength	$f_b \geq$ [N/mm^2]	6, 8 or 10
Standard or approval		EN 771-1
Producer		e.g. Perceram
Size, dimensions	[mm]	220x190x290
Minimum thickness of brick	h_{min} [mm]	190

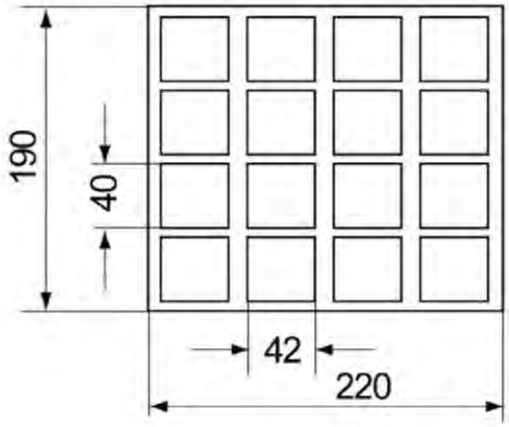

Table C80: Installation parameters for threaded rod with perforated sleeve and internal threaded anchor UPM-I with perforated sleeve

Size of perforated sleeve		12x50		12x85		16x85		16x130		18x130/200		20x85		20x130		22x130/200
Size of threaded rod		M6	M8	M6	M8	M8	M10	M8	M10	M10	M12	M12	M16	M12	M16	M16
Size of internal threaded anchor UPM-I						M6/M8						M10/M12				
Edge distance	c_{min} [mm]	110														
Spacing	s_{cr} II = s_{min} II [mm]	220														
	s_{cr} ⊥ = s_{min} ⊥ [mm]	290														
Group-factor	$\alpha_{g,N}$ II [-]	2,0														
	$\alpha_{g,V}$ II [-]															
	$\alpha_{g,N}$ ⊥ [-]															
	$\alpha_{g,V}$ ⊥ [-]															
Max. installation torque	$T_{inst,max}$ [Nm]	2														

Upat injection system UPM 44 masonry	**Annex C 50**
Performances Perforated brick HLz Species of brick, installation parameters	

Deutsches Institut für Bautechnik DIBt

Kind of masonry: Perforated brick HLz

Table C81: Characteristic values of resistance; tension load (N_{Rk})

Use category		w/w		d/d	
Temperature range [°C]		50/80	72/120	50/80	72/120
Sleeve/anchor combinations	Sleeve/anchor combinations	characteristic values N_{Rk} [kN]			
Compressive strength f_b = 6 N/mm²					
12x50 M6 / M8		0,30	--	0,40	0,30
12x85 M6 / M8	16x85 M8 / M10 16x85 / UPM-I M6 / M8 20x85 M12 / M16 20x85 / UPM-I M10 / M12	1,20	1,20	1,50	1,20
20x130 M12 / M16 22x130/200 M16	16x130 M8 / M10 18x130/200 M10 / M12	1,50	1,20	1,50	1,50
Compressive strength f_b = 8 N/mm²					
12x50 M6 / M8		0,50	0,40	0,50	0,40
12x85 M6 / M8	16x85 M8 / M10 16x85 / UPM-I M6 / M8 20x85 M12 / M16 20x85 / UPM-I M10 / M12	1,50	1,50	2,00	1,50
20x130 M12 / M16 22x130/200 M16	16x130 M8 / M10 18x130/200 M10 / M12	2,00	1,50	2,50	2,00
Compressive strength f_b = 10 N/mm²					
12x50 M6 / M8		0,60	0,50	0,60	0,50
12x85 M6 / M8	16x85 M8 / M10 16x85 / UPM-I M6 / M8 20x85 M12 / M16 20x85 / UPM-I M10 / M12	2,00	2,00	2,50	2,00
20x130 M12 / M16 22x130/200 M16	16x130 M8 / M10 18x130/200 M10 / M12	2,50	2,00	3,00	2,00

Factor for job site tests and displacements see Annex C78.

Upat injection system UPM 44 masonry	**Annex C 51**
Performances Perforated brick HLz Characteristic values tension load	

Deutsches Institut für Bautechnik DIBt

Kind of masonry: Perforated brick HLz

Table C82: Characteristic values of resistance; shear load (V_{Rk})

Use category		w/w		d/d	
Temperature range [°C]		50/80	72/120	50/80	72/120
Sleeve/anchor combinations	Sleeve/anchor combinations	characteristic values V_{Rk} [kN]			
Compressive strength f_b = 6 N/mm²					
12x50 M6 / M8		1,50			
12x85 M6 / M8	16x85 M8 / M10 16x85 / UPM-I M6 / M8 20x85 M12 / M16 20x85 / UPM-I M10 / M12	1,50			
16x130 M8 / M10		2,50			
20x130 M12 / M16	22x130/200 M16 18x130/200 M10 / M12	2,00			
Compressive strength f_b = 8 N/mm²					
12x50 M6 / M8		2,00			
12x85 M6 / M8	16x85 M8 / M10 16x85 / UPM-I M6 / M8 20x85 M12 / M16 20x85 / UPM-I M10 / M12	2,00			
16x130 M8 / M10		3,50			
20x130 M12 / M16	22x130/200 M16 18x130/200 M10 / M12	3,00			
Compressive strength f_b = 10 N/mm²					
12x50 M6 / M8		2,50			
12x85 M6 / M8	16x85 M8 / M10 16x85 / UPM-I M6 / M8 20x85 M12 / M16 20x85 / UPM-I M10 / M12	3,00			
16x130 M8 / M10		4,50			
20x130 M12 / M16	22x130/200 M16 18x130/200 M10 / M12	3,50			

Factor for job site tests and displacements see Annex C78.

Upat injection system UPM 44 masonry	**Annex C 52**
Performances Perforated brick HLz Characteristic values shear load	

Deutsches Institut für Bautechnik DIBt

Kind of masonry: Perforated brick HLz

Table C83: Parameters of brick

pecies of brick		Perforated brick HLz
Density	$\rho \geq$ [kg/dm^3]	0,8
Compressive strength	$f_b \geq$ [N/mm^2]	2, 4 or 6
Standard or approval		EN 771-1
Producer		e.g. Ziegelwerk Brenna
Size, dimensions	[mm]	253x300x240
Minimum thickness of brick	h_{min} [mm]	300

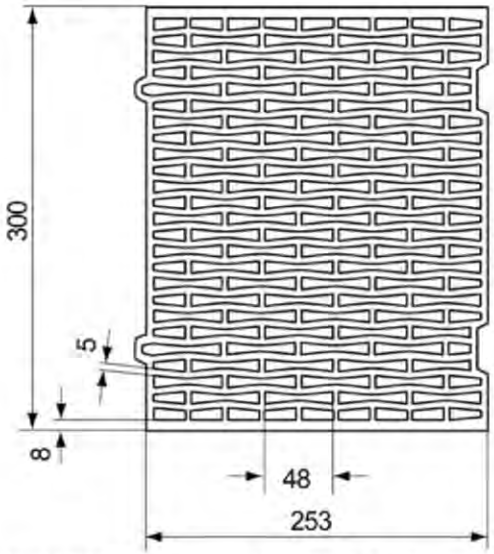

Table C84: Installation parameters for threaded rod with perforated sleeve and internal threaded anchor UPM-I with perforated sleeve

Size of perforated sleeve	12x50		12x85		16x85		16x130		18x130/200		20x85		20x130		22x130/200
Size of threaded rod	M6	M8	M6	M8	M8	M10	M8	M10	M10	M12	M12	M16	M12	M16	M16
Size of internal threaded anchor UPM-I					M6/M8						M10/M12				
Edge distance c_{min} [mm]	60														
Spacing s_{cr} II = s_{min} II [mm]	255														
Spacing $s_{cr}\perp$ = $s_{min}\perp$ [mm]	240														
Group-factor $\alpha_{g,N}$ II [-]	2,0														
Group-factor $\alpha_{g,V}$ II [-]	2,0														
Group-factor $\alpha_{g,N}\perp$ [-]	2,0														
Group-factor $\alpha_{g,V}\perp$ [-]	2,0														
Max. installation torque $T_{inst,max}$ [Nm]	2														

Upat injection system UPM 44 masonry	
Performances Perforated brick HLz Species of brick, installation parameters	**Annex C 53**

Deutsches Institut für Bautechnik DIBt

Kind of masonry: Perforated brick HLz

Table C85: Characteristic values of resistance; tension load (N_{Rk})

Use category		w/w		d/d	
Temperature range [°C]		50/80	72/120	50/80	72/120
Sleeve/anchor combinations	Sleeve/anchor combinations	characteristic values N_{Rk} [kN]			
Compressive strength f_b = **2 N/mm²**					
12x50 M6 / M8		--	--	0,30	--
12x85 M6 / M8	16x85 M8 / M10 16x85 / UPM-I M6 / M8 20x85 M12 / M16 20x85 / UPM-I M10 / M12	0,50	0,40	0,50	0,40
20x130 M12 / M16 22x130/200 / M16	16x130 M8 / M10 18x130/200 M10 / M12	0,40	0,30	0,50	0,40
Compressive strength f_b = **4 N/mm²**					
12x50 M6 / M8		0,50	0,40	0,60	0,50
12x85 M6 / M8	16x85 M8 / M10 16x85 / UPM-I M6 / M8 20x85 M12 / M16 20x85 / UPM-I M10 / M12	0,90	0,75	0,90	0,90
20x130 M12 / M16 22x130/200 / M16	16x130 M8 / M10 18x130/200 M10 / M12	0,90	0,75	0,90	0,75
Compressive strength f_b = **6 N/mm²**					
12x50 M6 / M8		0,75	0,60	0,90	0,75
12x85 M6 / M8	16x85 M8 / M10 16x85 / UPM-I M6 / M8 20x85 M12 / M16 20x85 / UPM-I M10 / M12	1,50	1,20	1,50	1,20
20x130 M12 / M16 22x130/200 / M16	16x130 M8 / M10 18x130/200 M10 / M12	1,20	0,90	1,50	1,20

Factor for job site tests and displacements see Annex C78.

Upat injection system UPM 44 masonry	**Annex C 54**
Performances Perforated brick HLz Characteristic values tension load	

Deutsches Institut für Bautechnik DIBt

Kind of masonry: Perforated brick HLz

Table C86: Characteristic values of resistance; shear load (V_{Rk})

Use category		w/w		d/d	
Temperature range [°C]		50/80	72/120	50/80	72/120
Sleeve/anchor combinations	Sleeve/anchor combinations	characteristic values V_{Rk} [kN]			
Compressive strength f_b = 2 N/mm²					
12x50 M6 / M8		0,50			
12x85 M6 / M8 16x130 M8 / M10	16x85 M8 / M10 16x85 / UPM-I M6 / M8 18x130/200 M10 / M 12 20x85 / UPM-I M10	0,50			
20x130 M12 / M16 22x130/200 M16	20x85 M12 / M16 20 x 85, UPM-I M12	0,60			
Compressive strength f_b = 4 N/mm²					
12x50 M6 / M8		0,90			
12x85 M6 / M8 16x130 M8 / M10	16x85 M8 / M10 16x85 / UPM-I M6 / M8 18x130/200 M10 / M 12 20x85 / UPM-I M10	0,90			
20x130 M12 / M16 22x130/200 M16	20x85 M12 / M16 20 x 85, UPM-I M12	1,20			
Compressive strength f_b = 6 N/mm²					
12x50 M6 / M8		1,50			
12x85 M6 / M8 16x130 M8 / M10	16x85 M8 / M10 16x85 / UPM-I M6 / M8 18x130/200 M10 / M 12 20x85 / UPM-I M10	1,50			
20x130 M12 / M16 22x130/200 M16	20x85 M12 / M16 20x85, UPM-I M12	1,50			

Factor for job site tests and displacements see Annex C78.

Upat injection system UPM 44 masonry	**Annex C 55**
Performances Perforated brick HLz Characteristic values shear load	

Deutsches Institut für Bautechnik DIBt

Kind of masonry: Solid light-weight concrete block Vbl

Table C87: Parameters of brick

Species of brick		Solid light-weight concrete block Vbl
Density	$\rho \geq$ [kg/dm^3]	2,0
Compressive strength	$f_b \geq$ [N/mm^2]	4, 6, 8 or 10
Standard or approval		
Producer		e.g. Roadstone wood
Size, dimensions	[mm]	≥ 440x100x215
Minimum thickness of brick	h_{min} [mm]	100

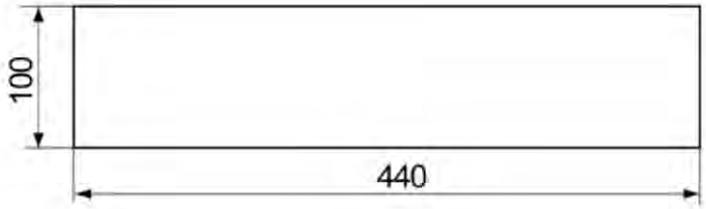

Table C88: Installation parameters for threaded rod (without perforated sleeve)

Size of threaded rod		M6		M8		M10		M12		M16	
Effective anchorage depth	h_{ef} [mm]	50	70	50	70	50	70	50	70	50	70
Edge distance	c_{min} [mm]	100									
Spacing	s_{min} ∥ [mm]	75									
	s_{cr} ∥ [mm]	440									
	s_{min} ⊥ [mm]	75									
	s_{cr} ⊥ [mm]	215									
Group-factor	$\alpha_{g,N}$ ∥ [-]	1,6									
	$\alpha_{g,V}$ ∥ [-]	1,3									
	$\alpha_{g,N}$ ⊥ [-]	1,4									
	$\alpha_{g,V}$ ⊥ [-]	1,3									
Max. installation torque	$T_{inst,max}$ [Nm]	4		10							

Upat injection system UPM 44 masonry	
Performances Solid light-weight concrete block Vbl Species of brick, installation parameters	**Annex C 56**

Deutsches Institut für Bautechnik DIBt

Kind of masonry: Solid light-weight concrete block Vbl

Table C89: Characteristic values of resistance; tension load (N_{Rk})

Use category		w/w		d/d	
Temperature range [°C]		50/80	72/120	50/80	72/120
Effective anchorage depth	Anchor size	characteristic values N_{Rk} [kN]			
Compressive strength f_b = 4 N/mm²					
≥ 50	M6	1,20	0,90	2,00	1,50
	M8 / M10 / M12 / M16	1,20	1,20	2,00	2,00
Compressive strength f_b = 6 N/mm²					
≥ 50	M6	1,50	1,50	3,00	2,50
	M8 / M10 / M12 / M16	2,00	1,50	3,50	2,50
Compressive strength f_b = 8 N/mm²					
≥ 50	M6	2,00	2,00	4,00	3,00
	M8 / M10 / M12 / M16	2,50	2,00	4,50	3,50
Compressive strength f_b = 10 N/mm²					
≥ 50	M6	3,00	2,50	5,00	4,00
	M8 / M10 / M12 / M16	3,50	2,50	5,50	4,50

Table C90: Characteristic values of resistance; shear load (V_{Rk})

Use category		w/w		d/d	
Temperature range [°C]		50/80	72/120	50/80	72/120
Effective anchorage depth	Anchor size	characteristic values V_{Rk} [kN]			
Compressive strength f_b = 4 N/mm²					
≥ 50	M6	1,20			
	M8	1,50			
	M10 / M12	1,50			
	M16	1,50			
Compressive strength f_b = 6 N/mm²					
≥ 50	M6	2,00			
	M8	2,00			
	M10 / M12	2,50			
	M16	2,50			
Compressive strength f_b = 8 N/mm²					
≥ 50	M6	2,50			
	M8	2,50			
	M10 / M12	3,00			
	M16	3,50			
Compressive strength f_b = 10 N/mm²					
≥ 50	M6	3,00			
	M8	3,50			
	M10 / M12	4,00			
	M16	4,50			

Factor for job site tests and displacements see Annex C78.

Upat injection system UPM 44 masonry	**Annex C 57**
Performances Solid light-weight concrete block Vbl Characteristic values	

Deutsches Institut für Bautechnik DIBt

Kind of masonry: Solid light-weight concrete block Vbl

Table C91: Parameters of brick

Species of brick		Solid light-weight concrete block Vbl
Density	$\rho \geq$ [kg/dm^3]	2,0
Compressive strength	$f_b \geq$ [N/mm^2]	6, 8 ,10 or 12
Standard or approval		
Producer		e.g. Tramac
Size, dimensions	[mm]	≥ 440x95x215
Minimum thickness of brick	h_{min} [mm]	95

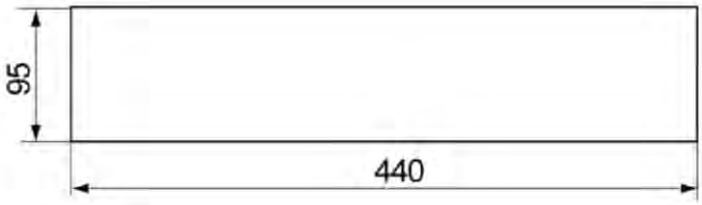

Table C92: Installation parameters for threaded rod without perforated sleeve

Size of threaded rod		M6		M8		M10		M12		M16	
Effective anchorage depth	h_{ef} [mm]	50	70	50	70	50	70	50	70	50	70
Edge distance	c_{min} [mm]	60									
Spacing	s_{min} ∥ [mm]	75									
	s_{cr} ∥ [mm]	440									
	s_{min} ⊥ [mm]	75									
	s_{cr} ⊥ [mm]	215									
Group-factor	$\alpha_{g,N}$ ∥ [-]	1,9									
	$\alpha_{g,V}$ ∥ [-]	1,4									
	$\alpha_{g,N}$ ⊥ [-]	1,9									
	$\alpha_{g,V}$ ⊥ [-]	1,4									
Max. installation torque	$T_{inst,max}$ [Nm]	4		10							

Upat injection system UPM 44 masonry	
Performances Solid light-weight concrete block Vbl Species of brick, installation parameters	**Annex C 58**

Deutsches Institut für Bautechnik DIBt

Kind of masonry: Solid light-weight concrete block Vbl

Table C93: Characteristic values of resistance; tension load (N_{Rk})

Use category		w/w		d/d	
Temperature range [°C]		50/80	72/120	50/80	72/120
Effective anchorage depth	Anchor size	characteristic values N_{Rk} [kN]			
Compressive strength f_b = 6 N/mm²					
50	M6 / M8 / M10 / M12 / M16	1,50	1,20	2,50	2,00
70	M6 / M8	2,00	1,50	3,50	3,00
	M10 / M12 / M16	2,00	2,00	3,50	3,00
Compressive strength f_b = 8 N/mm²					
50	M6 / M8 / M10 / M12 / M16	2,00	1,50	3,50	3,00
70	M6 / M8	2,50	2,00	4,50	4,00
	M10 / M12 / M16	3,00	2,50	5,00	4,00
Compressive strength f_b = 10 N/mm²					
50	M6 / M8 / M10 / M12 / M16	2,50	2,00	4,50	3,50
70	M6 / M8	3,50	3,00	6,00	5,00
	M10 / M12 / M16	3,50	3,00	6,00	5,00
Compressive strength f_b = 12 N/mm²					
50	M6 / M8 / M10 / M12 / M16	3,00	2,50	5,00	4,50
70	M6 / M8	4,00	3,50	7,00	6,00
	M10 / M12 / M16	4,50	3,50	7,50	6,00

Table C94: Characteristic values of resistance; shear load (V_{Rk})

Use category		w/w		d/d	
Temperature range [°C]		50/80	72/120	50/80	72/120
Effective anchorage depth	Anchor size	characteristic values V_{Rk} [kN]			
Compressive strength f_b = 6 N/mm²					
≥ 50	M6 / M8	2,00			
	M10	2,00			
	M12 / M16	1,50			
Compressive strength f_b = 8 N/mm²					
≥ 50	M6 / M8	2,50			
	M10	3,00			
	M12 / M16	2,50			
Compressive strength f_b = 10 N/mm²					
≥ 50	M6 / M8	3,50			
	M10	4,00			
	M12 / M16	3,00			
Compressive strength f_b = 12 N/mm²					
≥ 50	M6 / M8	4,00			
	M10	4,50			
	M12 / M16	3,50			

Factor for job site tests and displacements see Annex C78.

Upat injection system UPM 44 masonry	**Annex C 59**
Performances Solid light-weight concrete block Vbl Characteristic values	

Deutsches Institut für Bautechnik DIBt

Kind of masonry: Light-weight concrete hollow block Hbl

Table C95: Parameters of brick

Species of brick		Light-weight concrete hollow block Hbl
Density	$\rho \geq$ [kg/dm^3]	1,2
Compressive strength	$f_b \geq$ [N/mm^2]	4, 6, 8 or 10
Standard or approval		EN771-3
Producer		e.g. Roadstone wood
Size, dimensions	[mm]	≥ 440x215x215
Minimum thickness of brick	h_{min} [mm]	215

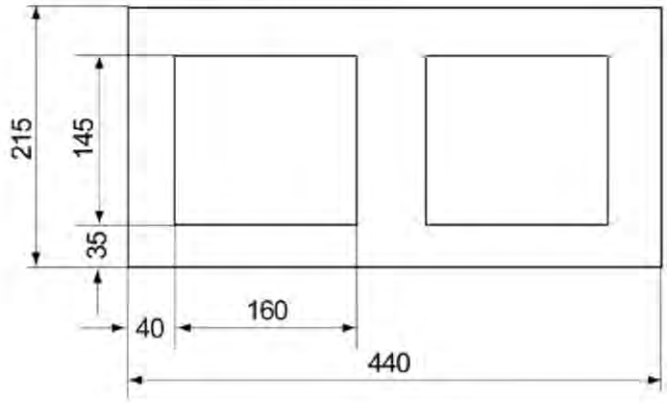

Table C96: Installation parameters for threaded rod and internal threaded anchor UPM-I with perforated sleeve

Size of perforated sleeve		12x50		12x85		16x85		16x130		18x130/200		20x85		20x130		22x130/200
Size of threaded rod		M6	M8	M6	M8	M8	M10	M8	M10	M10	M12	M12	M16	M12	M16	M16
Size of internal threaded anchor UPM-I						M6/M8						M10/M12				
Edge distance	c_{min} [mm]	110														
Spacing	s_{min} ∥ [mm]	100														
	s_{cr} ∥ [mm]	440														
	s_{min} ⊥ [mm]	100														
	s_{cr} ⊥ [mm]	215														
Group-factor	$\alpha_{g,N}$ ∥ [-]	1,4														
	$\alpha_{g,V}$ ∥ [-]	2,0														
	$\alpha_{g,N}$ ⊥ [-]	1,4														
	$\alpha_{g,V}$ ⊥ [-]	1,2														
Max. installation torque	$T_{inst,max}$ [Nm]	2														

Upat injection system UPM 44 masonry	
Performances Light-weight concrete hollow block Hbl Species of brick, installation parameters	**Annex C 60**

Deutsches Institut für Bautechnik DIBt

Kind of masonry: Light-weight concrete hollow block Hbl

Table C97: Characteristic values of resistance; tension load (N_{Rk})

Use category		w/w		d/d	
Temperature range [°C]		50/80	72/120	50/80	72/120
Sleeve/anchor combinations	Sleeve/anchor combinations	characteristic values N_{Rk} [kN]			
Compressive strength f_b = **4 N/mm²**					
12x50 M6 / M8	12x85 M6 / M8	0,90	0,90	1,20	0,90
16x85 M8 / M10 16x85 / UPM-I M6 / M8	16x130 M8 / M10 18x130/200 M10 / M12	1,20	0,90	1,50	1,20
20x85 M12 / M16 20x130 M12 / M16	22x130/200 M16 20x85 UPM-I M10 /M 12	2,00	1,50	2,00	1,50
Compressive strength f_b = **6 N/mm²**					
12x50 M6 / M8	12x85 M6 / M8	1,50	1,20	1,50	1,50
16x85 M8 / M10 16x85 / UPM-I M6 / M8	16x130 M8 / M10 18x130/200 M10 / M12	2,00	1,50	2,00	1,50
20x85 M12 / M16 20x130 M12 / M16	22x130/200 M16 20x85 UPM-I M10 /M 12	3,00	2,50	3,00	2,50
Compressive strength f_b = **8 N/mm²**					
12x50 M6 / M8	12x85 M6 / M8	2,00	1,50	2,00	2,00
16x85 M8 / M10 16x85 / UPM-I M6 / M8	16x130 M8 / M10 18x130/200 M10 / M12	2,50	2,00	3,00	2,50
20x85 M12 / M16 20x130 M12 / M16	22x130/200 M16 20x85 UPM-I M10 /M 12	3,50	3,00	4,00	3,50
Compressive strength f_b = **10 N/mm²**					
12x50 M6 / M8	12x85 M6 / M8	2,50	2,00	3,00	2,50
16x85 M8 / M10 16x85 / UPM-I M6 / M8	16x130 M8 / M10 18x130/200 M10 / M12	3,00	2,50	3,50	3,00
20x85 M12 / M16 20x130 M12 / M16	22x130/200 M16 20x85 UPM-I M10 /M 12	4,50	4,00	5,00	4,50

Factor for job site tests and displacements see Annex C78.

Upat injection system UPM 44 masonry	**Annex C 61**
Performances Light-weight concrete hollow block Hbl Characteristic values tension load	

Deutsches Institut für Bautechnik DIBt

Kind of masonry: Light-weight concrete hollow block Hbl

Table C98: Characteristic values of resistance; shear load (V_{Rk})

Use category		w/w		d/d	
Temperature range [°C]		50/80	72/120	50/80	72/120
Sleeve/anchor combinations	Sleeve/anchor combinations	characteristic values V_{Rk} [kN]			
Compressive strength f_b = 4 N/mm²					
12x50 M6 12x85 M6	16x85 / UPM-I M6	0,75			
12x50 M8 12x85 M8 16x85 M8 / M10 16x85 / UPM-I M8 16x130 M8 / M10	20x85 M12 / M16 20x85 UPM-I M10 / M12 20x130 M12 / M16 18x130/200 M12 22x130/200 M16	1,20			
Compressive strength f_b = 6 N/mm²					
12x50 M6 12x85 M6	16x85 / UPM-I M6	1,20			
12x50 M8 12x85 M8 16x85 M8 / M10 16x85 / UPM-I M8 16x130 M8 / M10	20x85 M12 / M16 20x85 UPM-I M10 / M12 20x130 M12 / M16 18x130/200 M12 22x130/200 M16	2,00			
Compressive strength f_b = 8 N/mm²					
12x50 M6 12x85 M6	16x85 / UPM-I M6	1,50			
12x50 M8 12x85 M8 16x85 M8 / M10 16x85 / UPM-I M8 16x130 M8 / M10	20x85 M12 / M16 20x85 UPM-I M10 / M12 20x130 M12 / M16 18x130/200 M12 22x130/200 M16	2,50			
Compressive strength f_b = 10 N/mm²					
12x50 M6 12x85 M6	16x85 / UPM-I M6	2,00			
12x50 M8 12x85 M8 16x85 M8 / M10 16x85 / UPM-I M8 16x130 M8 / M10	20x85 M12 / M16 20x85 UPM-I M10 / M12 20x130 M12 / M16 18x130/200 M12 22x130/200 M16	3,00			

Factor for job site tests and displacements see Annex C78.

Upat injection system UPM 44 masonry	**Annex C 62**
Performances Light-weight concrete hollow block Hbl Characteristic values shear load	

Deutsches Institut für Bautechnik DIBt

Kind of masonry: Solid brick Mz

Table C99: Parameters of brick

Species of brick		Solid brick Mz
Density	$\rho \geq$ [kg/dm^3]	1,8
Compressive strength	$f_b \geq$ [N/mm^2]	10 or 20
Standard or approval		EN 771-2
Producer		e.g. Wienerberger
Size, dimensions	[mm]	≥ 228x108x54
Minimum thickness of brick	h_{min} [mm]	108

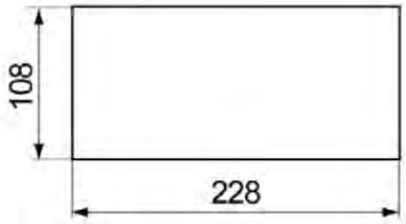

Table C100: Installation parameters for threaded rod and internal threaded anchor without perforated sleeve

Size of threaded rod		M6		M8		M10		M12		M16		UPM-I[1) M6/M8	UPM-I M10/M12
Effective anchorage depth	h_{ef} [mm]	50	90	50	90	50	90	50	90	50	90	85	85
Edge distance	c_{min} [mm]	60											
Spacing	s_{cr} II = s_{min} II [mm]	230											
	s_{cr} ⊥ = s_{min} ⊥ [mm]	60											
Group-factor	$\alpha_{g,N}$ II [-]	2,0											
	$\alpha_{g,V}$ II [-]												
	$\alpha_{g,N}$ ⊥ [-]												
	$\alpha_{g,V}$ ⊥ [-]												
Max. installation torque	$T_{inst,max}$ [Nm]	4		10									

[1) For UPM-I with screw M6: $T_{inst,max}$ = 4 Nm

Upat injection system UPM 44 masonry	
Performances Solid brick Mz Characteristic values	**Annex C 63**

Deutsches Institut für Bautechnik DIBt

Kind of masonry: Solid brick Mz

Table C101: Characteristic values of resistance; tension load (N_{Rk})

Use category		w/w		d/d	
Temperature range [°C]		50/80	72/120	50/80	72/120
Effective anchorage depth	Anchor size	characteristic values N_{Rk} [kN]			
Compressive strength f_b = 10 N/mm²					
≥ 50	M6	0,60	0,50	1,20	0,90
≥ 50	M8	0,90	0,90	1,50	1,50
≥ 50	M10 / M12 / M16	0,75	0,60	1,20	1,20
85	UPM-I M6 / M8 UPM-I M10 / M12				
Compressive strength f_b = 20 N/mm²					
≥ 50	M6	0,90	0,75	1,50	1,20
≥ 50	M8	1,50	1,20	2,50	2,00
≥ 50	M10 / M12 / M16	1,20	0,90	2,00	1,50
85	UPM-I M6 / M8 UPM-I M10 / M12				

Table C102: Characteristic values of resistance; shear load (V_{Rk})

Use category		w/w		d/d	
Temperature range [°C]		50/80	72/120	50/80	72/120
Effective anchorage depth	Anchor size	characteristic values V_{Rk} [kN]			
Compressive strength f_b = 10 N/mm²					
≥ 50	M6	2,00			
85	UPM-I M6				
≥ 50	M8	3,00			
85	UPM-I M8				
≥ 50	M10	4,00			
85	UPM-I M10				
≥ 50	M12	4,50			
85	UPM-I M12				
≥ 50	M16	5,50			
Compressive strength f_b = 20 N/mm²					
≥ 50	M6	2,50			
85	UPM-I M6				
≥ 50	M8	4,00			
85	UPM-I M8				
≥ 50	M10	5,50			
85	UPM-I M10				
≥ 50	M12	6,00 (5,5)[1]			
85	UPM-I M12				
≥ 50	M16	8,00 (5,5)[1]			

[1] Characteristic value pushing out of one brick $V_{Rk,pb}$= 5,50 kN

Factor for job site tests and displacements see Annex C78

Upat injection system UPM 44 masonry	**Annex C 64**
Performances Solid brick Mz Characteristic values	

Deutsches Institut für Bautechnik DIBt

Kind of masonry: Solid sand-lime block KS

Table C103: Parameters of brick

Species of brick		Solid sand-lime block KS	
Density	$\rho \geq$ [kg/dm^3]	1,8	2,2
Compressive strength	$f_b \geq$ [N/mm^2]	10, 20	36
Standard or approval		EN 771-2	
Producer		e.g. Calduran	
Size, dimensions	[mm]	≥ 997x214x538	
Minimum thickness of brick	h_{min} [mm]	214	

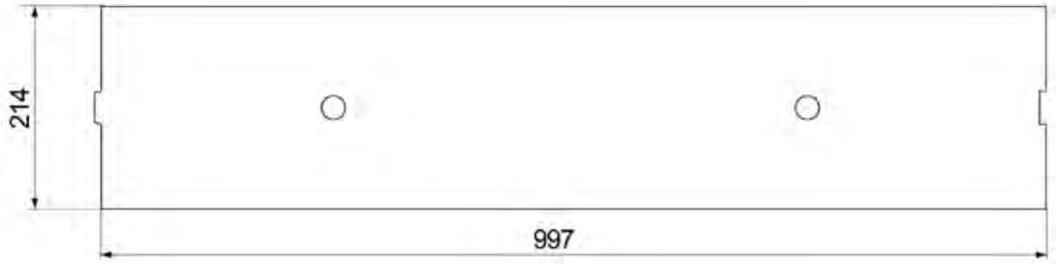

Table C104: Installation parameters for threaded rod and internal threaded anchor without perforated sleeve

Size of threaded rod		M6		M8		M10		M12		M16		UPM-I[1)] M6/M8	UPM-I M10/M12
Effective anchorage depth	h_{ef} [mm]	50	100	50	100	50	100	50	100	50	100	85	85
Edge distance	c_{min} [mm]	75											
Spacing	s_{min} II = s_{min} II [mm]	300											
	s_{min} ⊥ = s_{min} ⊥ [mm]	300											
Group-factor	$\alpha_{g,N}$ II [-]	2,0											
	$\alpha_{g,V}$ II [-]												
	$\alpha_{g,N}$ ⊥ [-]												
	$\alpha_{g,V}$ ⊥ [-]												
Max. installation torque	$T_{inst,max}$ [Nm]	4		10									

[1)] FOR UPM-I with screw M6: $T_{inst,max}$= 4 Nm

Upat injection system UPM 44 masonry	**Annex C 65**
Performances Solid sand-lime block KS Species of brick, installation parameters	

Deutsches Institut für Bautechnik DIBt

Kind of masonry: Solid sand-lime block KS

Table C105: Characteristic values of resistance; tension load (N_{Rk})

	Use category	w/w		d/d	
Temperature range	[°C]	50/80	72/120	50/80	72/120
Effective anchorage depth	Anchor size	characteristic values N_{Rk} [kN]			
Compressive strength f_b = **10 N/mm²**					
50, 100	M6	4,00	3,00	7,00	5,50
50	M8	4,00	3,50	7,00	6,00
100	M8	7,00	6,00	12,00	10,00
50	M10	5,00	4,00	8,00	7,00
100	M10	6,00	5,00	9,50	8,00
50	M12	5,00	4,00	8,00	6,50
100	M12	6,00	5,00	10,00	8,00
≥50	M16	5,50	4,50	9,00	7,50
85	UPM-I M6/M8,UPM-I M10/M12				
100	M16	7,50	6,00	11,50	9,50
Compressive strength f_b = **20 N/mm²**					
50, 100	M6	5,50	4,50	8,50	8,00
50	M8	6,00	5,00	10,50	8,50
100	M8	10,00	8,50	12,00	12,00
50	M10	7,00	6,00	11,50	10,00
100	M10	8,5	7,00	12,00	10,00
50	M12	7,00	6,00	11,00	9,50
100	M12	9,00	7,50	12,00	12,00
≥50	M16	8,00	7,00	12,00	10,50
85	UPM-I M6/M8,UPM-I M10/M12				
100	M16	11,00	9,00	12,00	12,00
Compressive strength f_b = **36 N/mm²**					
50, 100	M6	4,50	3,50	8,00	6,50
50	M8	8,00	6,50	12,00	11,00
100	M8	12,00	12,00	12,00	12,00
50	M10	11,50	9,50	12,00	12,00
100	M10	12,00	12,00	12,00	12,00
50	M12	12,00	11,50	12,00	12,00
100	M12	12,00	12,00	12,00	12,00
≥50	M16	12,00	12,00	12,00	12,00
85	UPM-I M6/M8,UPM-I M10/M12				
100	M16	12,00	12,00	12,00	12,00

Factor for job site tests and displacements see Annex C78.

Upat injection system UPM 44 masonry	**Annex C 66**
Performances Solid sand-lime block KS Characteristic values tension load	

Deutsches Institut für Bautechnik DIBt

Kind of masonry: Solid sand-lime block KS

Table C106: Characteristic values of resistance; shear load (V_{Rk})

Use category		w/w		d/d	
Temperature range [°C]		50/80	72/120	50/80	72/120
Effective anchorage depth	Anchor size	characteristic values V_{Rk} [kN]			
Compressive strength f_b = **10 N/mm²**					
≥50	M6	3,00			
85	UPM-I M6				
≥50	M8	5,00			
85	UPM-I M8				
≥50	M10	5,50			
85	UPM-I M10				
≥50	M12 / M16	4,00			
85	UPM-I M12				
Compressive strength f_b = **20 N/mm²**					
≥50	M6	4,50			
85	UPM-I M6				
≥50	M8	7,00			
85	UPM-I M8				
≥50	M10	7,50			
85	UPM-I M10				
≥50	M12 / M16	6,00			
85	UPM-I M12				
Compressive strength f_b = **36 N/mm²**					
≥50	M6	4,50			
85	UPM-I M6				
≥50	M8	9,00			
85	UPM-I M8				
≥50	M10	11,00			
85	UPM-I M10				
≥50	M12 / M16	12,00			
85	UPM-I M12				

Factor for job site tests and displacements see Annex C78.

Upat injection system UPM 44 masonry	**Annex C 67**
Performances Solid sand-lime block KS Characteristic values shear load	

Kind of masonry: Perforated brick HLz

Table C107: Parameters of brick

Species of brick		Perforated brick HLz
Density	$\rho \geq$ [kg/dm^3]	≥ 1,4
Compressive strength	$f_b \geq$ [N/mm^2]	2, 4, 6 or 8
Standard or approval		EN 771-1
Producer		e.g. Wienerberger
Size, dimensions	[mm]	230x108x55
Minimum thickness of brick	h_{min} [mm]	108

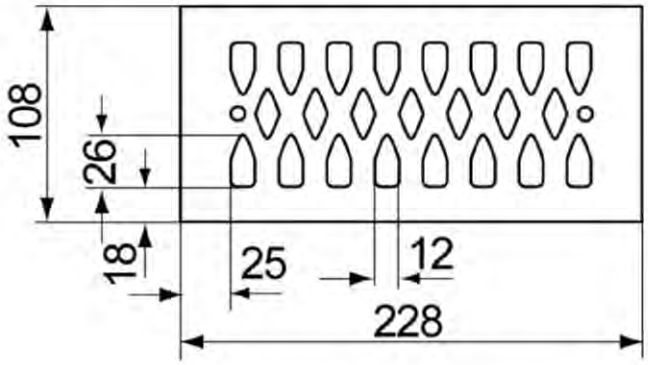

Table C108: Installation parameters for threaded rod with perforated sleeve and internal threaded anchor UPM-I with perforated sleeve

Size of perforated sleeve		12x50		12x85		16x85		20x85	
Size of threaded rod		M6	M8	M6	M8	M8	M10	M12	M16
Size of internal threaded anchor UPM-I						M6/M8		M10/M12	
Edge distance	c_{min} [mm]	60							
Spacing	s_{min} ∥ [mm]	80							
	s_{cr} ∥ [mm]	230							
	s_{min} ⊥ [mm]	60							
Group-factor	$\alpha_{g,N}$ ∥ [-]	2,0							
	$\alpha_{g,V}$ ∥ [-]								
	$\alpha_{g,N}$ ⊥ [-]								
	$\alpha_{g,V}$ ⊥ [-]								
Max. installation torque	$T_{inst,max}$ [Nm]	2							

Upat injection system UPM 44 masonry	**Annex C 68**
Performances Perforated brick HLz Species of brick, installation parameters	

Deutsches Institut für Bautechnik DIBt

Kind of masonry: Perforated brick HLz

Table C109: Characteristic values of resistance; tension load (N_{Rk})[1)]

Use category		w/w		d/d	
Temperature range [°C]		50/80	72/120	50/80	72/120
Sleeve/anchor combinations	Sleeve/anchor combinations	characteristic values N_{Rk} [kN]			
Compressive strength f_b = **2 N/mm²**					
12x50 M6 / M8		0,30	--	0,30	0,30
12x85 M6 / M8		0,90	0,75	0,90	0,75
16x85 M8 / M10	16x85 / UPM-I M6 / M8	0,75	0,60	0,90	0,75
20x85 M12 / M16	20x85 / UPM-I M10 / M12	0,50	0,40	0,60	0,50
Compressive strength f_b = **4 N/mm²**					
12x50 M6 / M8		0,60	0,50	0,75	0,60
12x85 M6 / M8		1,50	1,50	2,00	1,50
16x85 M8 / M10	16x85 / UPM-I M6 / M8	1,50	1,20	1,50	1,50
20x85 M12 / M16	20x85 / UPM-I M10 / M12	0,90	0,90	1,20	0,90
Compressive strength f_b = **6 N/mm²**					
12x50 M6 / M8		0,90	0,75	0,90	0,90
12x85 M6 / M8		2,50	2,00	3,00	2,50
16x85 M8 / M10	16x85 / UPM-I M6 / M8	2,50	2,00	2,50	2,00
20x85 M12 / M16	20x85 / UPM-I M10 / M12	1,50	1,20	1,50	1,50
Compressive strength f_b = **8 N/mm²**					
12x50 M6 / M8		1,20	0,90	1,50	1,20
12x85 M6 / M8		3,50	3,00	4,00	3,00
16x85 M8 / M10	16x85 / UPM-I M6 / M8	3,00	2,50	3,50	3,00
20x85 M12 / M16	20x85 / UPM-I M10 / M12	2,00	1,50	2,50	2,00

[1)] If the fixing is in a solid area, for w/w, the characteristic values shall be reduced with the factor 0,64.

Factor for job site tests and displacements see Annex C78.

Upat injection system UPM 44 masonry	**Annex C 69**
Performances Perforated brick HLz Characteristic values tension load	

Deutsches Institut für Bautechnik DIBt

Kind of masonry: Perforated brick HLz

Table C110: Characteristic values of resistance; shear load (V_{Rk})

Use category		w/w		d/d	
Temperature range [°C]		50/80	72/120	50/80	72/120
Sleeve/anchor combinations	Sleeve/anchor combinations	characteristic values V_{Rk} [kN]			
Compressive strength f_b = **2 N/mm²**					
12x50 M6 / M8 12x85 M6 / M8	16x85 M8 / M10 16x85 UPM-I M6 / M8	0,6			
20x85 M12 / M16	20x85 / UPM-I M10 / M12	0,4			
Compressive strength f_b = **4 N/mm²**					
12x50 M6 / M8 12x85 M6 / M8	16x85 M8 / M10 16x85 UPM-I M6 / M8	1,2			
20x85 M12 / M16	20x85 / UPM-I M10 / M12	0,9			
Compressive strength f_b = **6 N/mm²**					
12x50 M6 / M8 12x85 M6 / M8	16x85 M8 / M10 16x85 UPM-I M6 / M8	1,5			
20x85 M12 / M16	20x85 / UPM-I M10 / M12	1,2			
Compressive strength f_b = **8 N/mm²**					
12x50 M6 / M8 12x85 M6 / M8	16x85 M8 / M10 16x85 UPM-I M6 / M8	2,5			
20x85 M12 / M16	20x85 / UPM-I M10 / M12	1,5			

Factor for job site tests and displacements see Annex C78.

Upat injection system UPM 44 masonry	**Annex C 70**
Performances Perforated brick HLz Characteristic values shear load	

Deutsches Institut für Bautechnik DIBt

Kind of masonry: Autoclaved aerated concrete

Cylindrical drill hole

Table C111: Parameters of brick

Species of brick		Autoclaved aerated concrete		
Density	$\rho \geq$ [kg/dm^3]	350	500	650
Compressive strength	$f_b \geq$ [N/mm^2]	2	4	6
Standard		EN 771-4		
Producer		e.g. Ytong		

Table C112: Installation parameters for threaded rod and internal threaded anchor without perforated sleeve

Size of threaded rod		M6	M8	M10	M12	M16	UPM-I M6 / M8	UPM-I M10/ M12
Effective anchorage depth	h_{ef} [mm]	100					85	
Edge distance	c_{min} [mm]	100						
Spacing	s_{cr} II = s_{min} II [mm]	250						
	s_{cr} ⊥ = s_{min} ⊥ [mm]	250						
Group-factor	$\alpha_{g,N}$ II [-]	2,0						
	$\alpha_{g,V}$ II [-]							
	$\alpha_{g,N}$ ⊥ [-]							
	$\alpha_{g,V}$ ⊥ [-]							
Max. installation torque	$T_{inst,max}$ [Nm]	1		2			1	2

Upat injection system UPM 44 masonry	
Performances Autoclaved aerated concrete Cylindrical drill hole Installation parameters	**Annex C 71**

Deutsches Institut für Bautechnik DIBt

Kind of masonry: Autoclaved aerated concrete (cylindrical drill hole)

Table C113: Characteristic values of resistance; tension load (N_{Rk})

	Use category	w/w		d/d	
Temperature range	[°C]	50/80	72/120	50/80	72/120
Effective anchorage depth	Anchor size	characteristic values N_{Rk} [kN]			
Compressive strength f_b = 2 N/mm²					
100	M6	1,20		1,50	
	M8	1,50		1,50	
	M10	1,50		1,50	
	M12	1,50		2,00	
	M16	2,00		2,00	
85	UPM-I M6 / M 8	1,50		1,50	
	UPM-I M10 / M 12	1,50		1,50	
Compressive strength f_b = 4 N/mm²					
100	M6	1,20		1,50	
	M8	2,00		2,00	
	M10	2,50		3,00	
	M12	2,50		2,50	
	M16	2,00		2,00	
85	UPM-I M6 / M 8	2,00		2,00	
	UPM-I M10 / M 12	1,50		1,50	
Compressive strength f_b = 6 N/mm²					
100	M6	1,50		1,50	
	M8	3,00		3,50	
	M10	4,50		5,00	
	M12	4,50		5,00	
	M16	3,00		3,00	
85	UPM-I M6 / M 8	3,50		3,50	
	UPM-I M10 / M 12	2,50		2,50	

Calculation of pulling out of one brick (tension load): $N_{Rk,pb}$ see ETAG 029, Annex C

Factor for job site tests and displacements see Annex C78.

Upat injection system UPM 44 masonry	**Annex C 72**
Performances Autoclaved aerated concrete Cylindrical drill hole Characteristic values tension load	

Deutsches Institut für Bautechnik DIBt

Kind of masonry: Autoclaved aerated concrete (cylindrical drill hole)

Table C114: Characteristic values of resistance; shear load (V_{Rk})

	Use category	w/w		d/d	
Temperature range	[°C]	50/80	72/120	50/80	72/120
Effective anchorage depth	Anchor size	characteristic values V_{Rk} [kN]			
Compressive strength f_b = 2 N/mm²					
85	UPM-I M6 UPM-I M8 UPM-I M10	1,20			
	UPM-I M12	1,50			
100	M12	1,50			
100	M6, M8, M10, M16	1,20			
Compressive strength f_b = 4 N/mm²					
85	UPM-I M6 UPM-I M8 UPM-I M10	2,00			
85	UPM-I M12	2,50			
100	M8, M12	2,50			
100	M6, M10, M16	2,00			
Compressive strength f_b = 6 N/mm²					
85	UPM-I M6 UPM-I M8 UPM-I M10	2,50			
85	UPM-I M12	3,50			
100	M6	2,5			
100	M8, M10	3,0			
100	M12	3,50			
100	M16	4,50			

Calculation of pushing out of one brick (shear load): $V_{Rk,pb}$ see ETAG 029, Annex C

Factor for job site tests and displacements see Annex C78.

Upat injection system UPM 44 masonry	**Annex C 73**
Performances Autoclaved aerated concrete Cylindrical drill hole Characteristic values shear load	

Deutsches Institut für Bautechnik DIBt

Kind of masonry: Autoclaved aerated concrete

Conical drill hole (with special drill bit PBB)

Table C115: Parameters of brick

Species of brick		Autoclaved aerated concrete		
Density	$\rho \geq$ [kg/dm^3]	350	500	650
Compressive strength	$f_b \geq$ [N/mm^2]	2	4	6
Standard or approval		EN 771-4		
Producer		e.g. Ytong		

Table C116: Installation parameters for threaded rod and internal threaded anchor without perforated sleeve

Size of threaded rod		M8	M10	M12	M8	M10	M12	UPM-I M6/M8
Effective anchorage depth	h_{ef} [mm]	75			95			85
Edge distance	c_{min} [mm]	120			150			
Spacing	s_{cr} II = s_{min} II [mm]	240			300			
	s_{cr} ⊥ = s_{min} ⊥ [mm]	240			250			
Group-factor	$\alpha_{g,N}$ II [-]	2,0						
	$\alpha_{g,V}$ II [-]							
	$\alpha_{g,N}$ ⊥ [-]							
	$\alpha_{g,V}$ ⊥ [-]							
Max. installation torque	$T_{inst,max}$ [Nm]	2						

Upat injection system UPM 44 masonry	
Performances Autoclaved aerated concrete Conical drill hole with drill bit PBB Installation parameters	**Annex C 74**

Kind of masonry: Autoclaved aerated concrete

Conical drill hole (with special drill bit PBB)

Table C117: Characteristic values of resistance; tension load (N_{Rk})

Use category		w/w		d/d	
Temperature range [°C]		50/80	72/120	50/80	72/120
Effective anchorage depth	Anchor size	characteristic values N_{Rk} [kN]			
Compressive strength f_b = 2 N/mm²					
75	M8 / M10 / M12	2,00	1,50	2,00	2,00
95	M8 / M10 / M12	2,50	2,00	2,50	2,50
85	UPM-I M6 / M8	2,00	1,50	2,00	2,00
Compressive strength f_b = 4 N/mm²					
75	M8 / M10 / M12	3,00	1,50	3,00	2,50
95	M8 / M10 / M12	3,50	3,00	3,50	3,00
85	UPM-I M6 / M8	3,00	2,50	3,00	2,50
Compressive strength f_b = 6 N/mm²					
75	M8 / M10 / M12	3,50	3,00	4,00	3,50
95	M8 / M10 / M12	4,00	4,00	4,50	4,00
85	UPM-I M6 / M8	3,50	3,00	4,00	3,50

Calculation of pulling out of one brick (tension load): $N_{Rk,pb}$ see ETAG 029, Annex C

Table C118: Characteristic values of resistance; shear load (V_{Rk})

Use category		w/w		d/d	
Temperature range [°C]		50/80	72/120	50/80	72/120
Effective anchorage depth	Anchor size	characteristic values V_{Rk} [kN]			
Compressive strength f_b = 2 N/mm²					
75, 95, 85	all sizes	2,50			
Compressive strength f_b = 4 N/mm²					
75, 95, 85	all sizes	4,50			
Compressive strength f_b = 6 N/mm²					
75, 95, 85	all sizes	6,00			

Calculation of pushing out of one brick (shear load): $V_{Rk,pb}$ see ETAG 029, Annex C

Factor for job site tests and displacements see Annex C78

Upat injection system UPM 44 masonry	**Annex C 75**
Performances Autoclaved aerated concrete Conical drill hole with drill bit PBB Characteristic values	

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Table C119: Characteristic bending moments for threaded rods

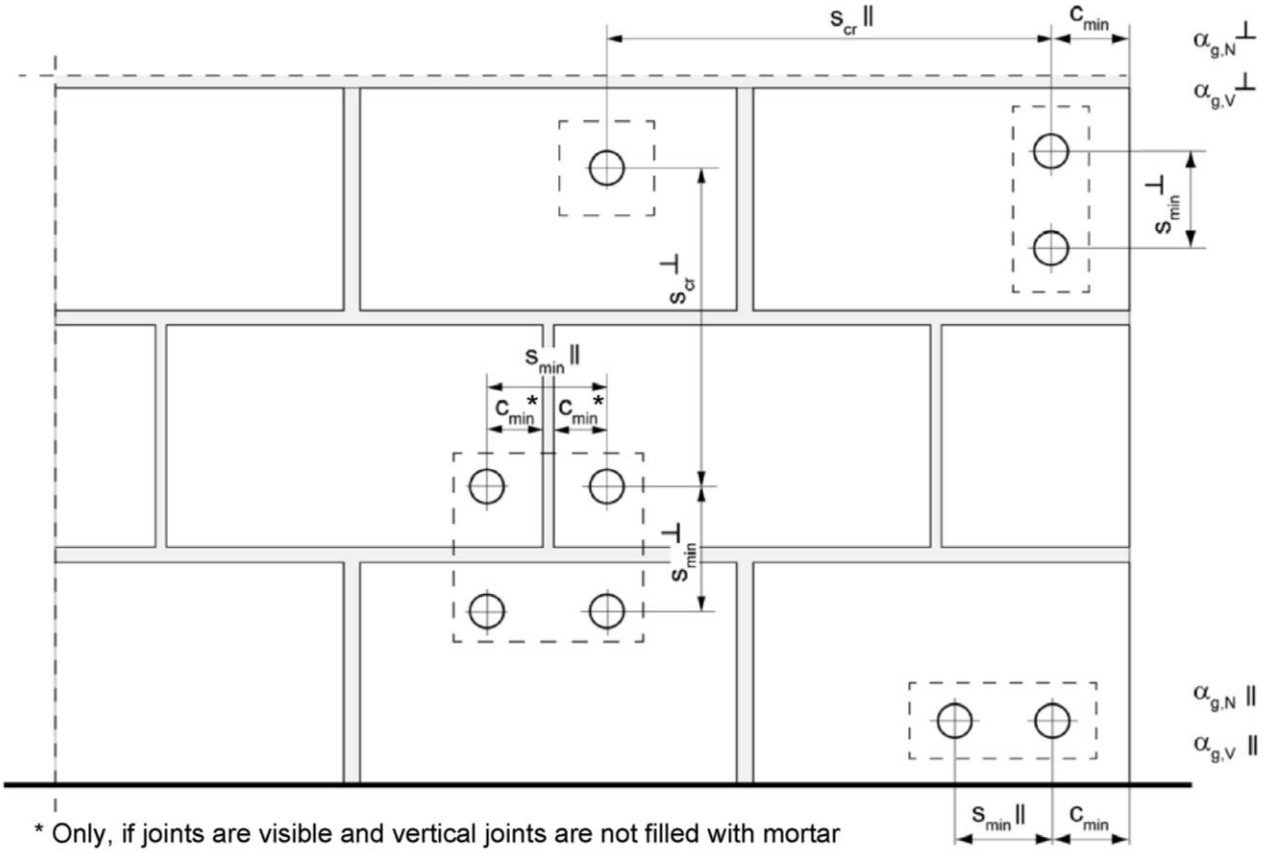
Size				M6	M8	M10	M12	M16
Characteristic bending moments $M_{Rk,s}$	zinc plated steel	Property class	5.8 [Nm]	8	19	37	65	166
			8.8 [Nm]	12	30	60	105	266
	stainless steel A4	Property class	50 [Nm]	8	19	37	65	166
			70 [Nm]	11	26	52	92	232
			80 [Nm]	12	30	60	105	266
	high corrosion resistant steel C	Property class	50 [Nm]	8	19	37	65	166
			70[1)] [Nm]	11	26	52	92	232
			80 [Nm]	12	30	60	105	266

[1)] f_{uk}= 700 N/mm^2; f_{yk}=560 N/mm^2

Table C120: Characteristic bending moments for internal threaded anchors UPM-I

Size UPM-I				M6	M8	M10	M12
Characteristic bending moments $M_{Rk,s}$	zinc plated steel,	Property class of screw	5.8 [Nm]	8	19	37	65
			8.8 [Nm]	12	30	60	105
	stainless steel A4	Property class of screw	70 [Nm]	11	26	52	92
	high corrosion resistant steel C	Property class of screw	70 [Nm]	11	26	52	92

Upat injection system UPM 44 masonry	**Annex C 76**
Performances Characteristic bending moments	



* Only, if joints are visible and vertical joints are not filled with mortar

$s_{min}\,\|$ = Minimum spacing parallel to bed joint
$s_{min}\,\perp$ = Minimum spacing vertical to bed joint
$s_{cr}\,\|$ = Characteristic spacing parallel to bed joint
$s_{cr}\,\perp$ = Characteristic spacing vertical to bed joint
$c_{cr} = c_{min}$ = Edge distance
$\alpha_{g,N}\,\|$ = Group factor for tension load parallel to bed joint
$\alpha_{g,V}\,\|$ = Group factor for shear load parallel to bed joint
$\alpha_{g,N}\,\perp$ = Group factor for tension load vertical to bed joint
$\alpha_{g,V}\,\perp$ = Group factor for shear load vertical to bed joint

For $s > s_{cr}$ $\alpha_g = 2$

For $s_{min} \leq s \leq s_{cr}$ α_g according to installation parameters of brick

$N^g_{Rk} = \alpha_{g,N} \cdot N_{Rk}$; $V^g_{Rk} = \alpha_{g,V} \cdot V_{Rk}$ (Group of 2 anchors)

$N^g_{Rk} = \alpha_{g,N}\,\| \cdot \alpha_{g,N}\,\perp \cdot N_{Rk;}$ $V^g_{Rk} = \alpha_{g,V}\,\| \cdot \alpha_{g,V}\,\perp \cdot V_{Rk}$ (Group of 4 anchors)

Upat injection system UPM 44 masonry	**Annex C 77**
Performances Definition of minimum edge distance, minimum spacing and group factors	

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Table C121: ß- factors for job site tests

Tension load

Use category		w/w		d/d	
Temperature range		50/80	72/120	50/80	72/120
Material	Size				
solid units	M6	0,55	0,46	0,96	0,80
	M8	0,57	0,51		
	M10	0,59	0,52		
	M12 UPM-I M6, M8	0,60	0,54		
	M16 UPM-I M10, M12	0,62	0,52		
	16x85	0,55	0,46		
hollow units	all size	0,86	0,72	0,96	0,80
Autoclaved aerated concrete, cylindrical drill hole	all size	0,73	0,73	0,81	0,81
Autoclaved aerated concrete, conical drill hole	all size	0,66	0,59	0,73	0,66

Table C122: Displacements

Material	N [kN]	δN_0 [mm]	δN_∞ [mm]	V [kN]	δV_0 [mm]	δV_∞ [mm]
Solid units and autoclaved aerated concrete	$\frac{N_{Rk}}{1,4 * \gamma_M}$	0,03	0,06	$\frac{V_{Rk}}{1,4 * \gamma_M}$	0,59	0,88
hollow units	$\frac{N_{Rk}}{1,4 * \gamma_M}$	0,03	0,06	$\frac{V_{Rk}}{1,4 * \gamma_M}$	1,71	2,56
brick Annex C36/C37	$\frac{N_{Rk}}{1,4 * \gamma_M}$	0,03	0,06	$\frac{V_{Rk}}{1,4 * \gamma_M}$	6,44	9,66

Upat injection system UPM 44 masonry	
Performances ß- factors for job site tests, Displacements	**Annex C 78**