Deutsches Institut für Bautechnik

Member of EOTA
www.eota.eu

Approval body for construction products and types of construction

Bautechnisches Prüfamt

An institution established by the Federal and Laender Governments

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

# European Technical Assessment ETA-15/0554 of 27 August 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 33 for use in masonry |
| Product family to which the construction product belongs | Injection system for use in masonry |
| Manufacturer | Upat Vertriebs GmbH<br>Otto-Hahn Straße 15<br>79211 Denzlingen<br>DEUTSCHLAND |
| Manufacturing plant | Upat |
| This European Technical Assessment contains | 26 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,<br>used as European Assessment Document (EAD) according to Article 66 Paragraph 3 of Regulation (EU) No 305/2011. |

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

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

This European Technical Assessment may be withdrawn by the issuing Technical Assessment Body, in particular pursuant to information by the Commission in accordance with Article 25(3) of Regulation (EU) No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

## Specific Part

### 1 Technical description of the product

The Upat injectionsystem UPM 33 for masonry is a bonded anchor (injection type) consisting of a mortar cartridge with injection mortar Upat UPM 33, UPM 33 Express and UPM 33 Relax, a perforated sieve sleeve and an anchor rod with hexagon nut and washer or an internal threaded rod. The steel elements are made of zinc coated steel, stainless steel or high corrosion resistant steel.

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

The product description is given in Annex A.

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

The performances given in Section 3 are only valid if the 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 4 |
| Characteristic resistance for bending moments | See Annex C 5 |
| Displacements under shear and tension loads | See Annex C 5 |
| Reduction Factor for job site tests (β-Factor) | See Annex C 6 |
| Edge distances and spacing | See Annex C 7 – C8 |

#### 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 27 August 2015 by Deutsches Institut für Bautechnik

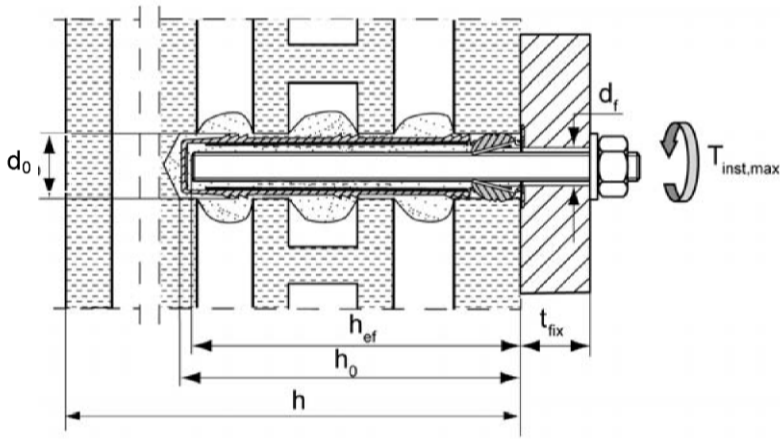
Uwe Bender
Head of Department

*beglaubigt:*
Baderschneider

Deutsches Institut für Bautechnik DIBt

**Installation conditions part 1;**

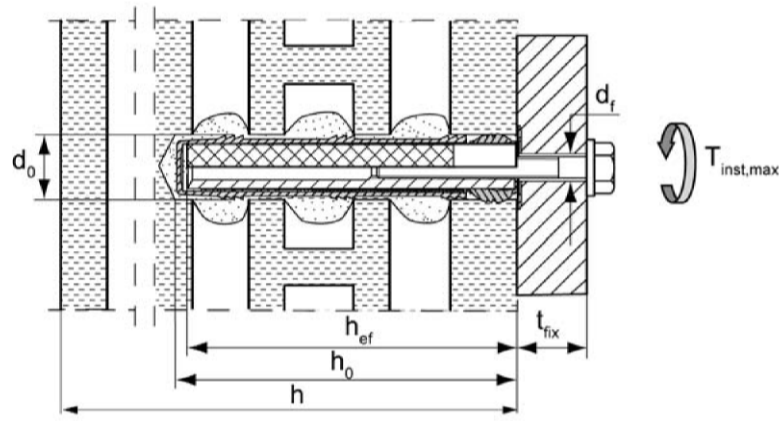
**Threaded rods with perforated sleeve UPM SH K; Installation in perforated and solid brick masonry**




**Pre-positioned installation**

UPM SH 12x85 K
UPM SH 16x85 K
UPM SH 16x130 K
UPM SH 20x85 K
UPM SH 20x130 K
UPM SH 20x200 K

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




**Pre-positioned installation**

UPM SH 16x85 K – UPM-I M6 and M8
UPM SH 20x85 K- UPM-I M10 and M12

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

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

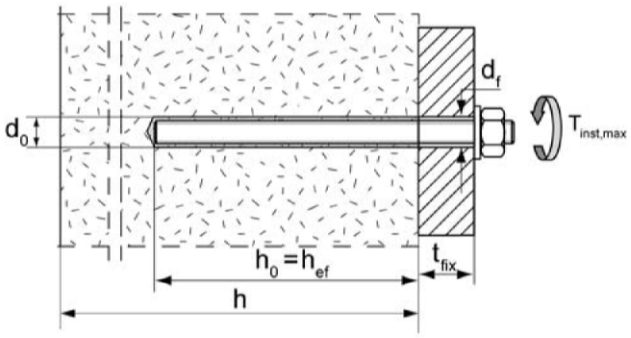
| Upat Injectionsystem UPM 33 for masonry | Annex A 1 |
|---|---|
| **Product description**<br>Installation condition, part 1: in perforated and solid brick masonry | |

Deutsches Institut für Bautechnik DIBt

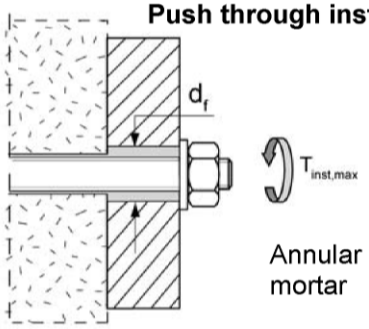
**Installation conditions part 2;**

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

**Pre-positioned installation**

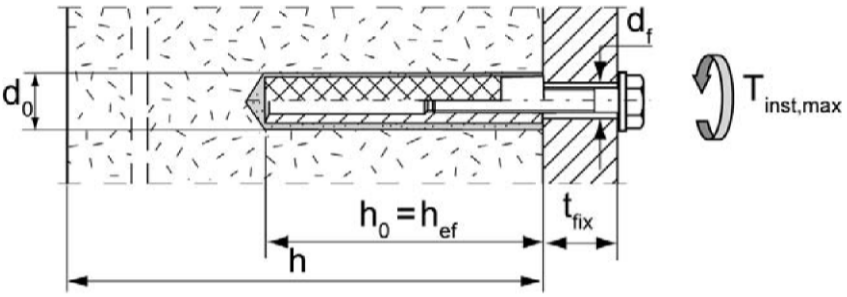



**Push through installation**




Annular gap filled with mortar

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




**Pre-positioned installation**

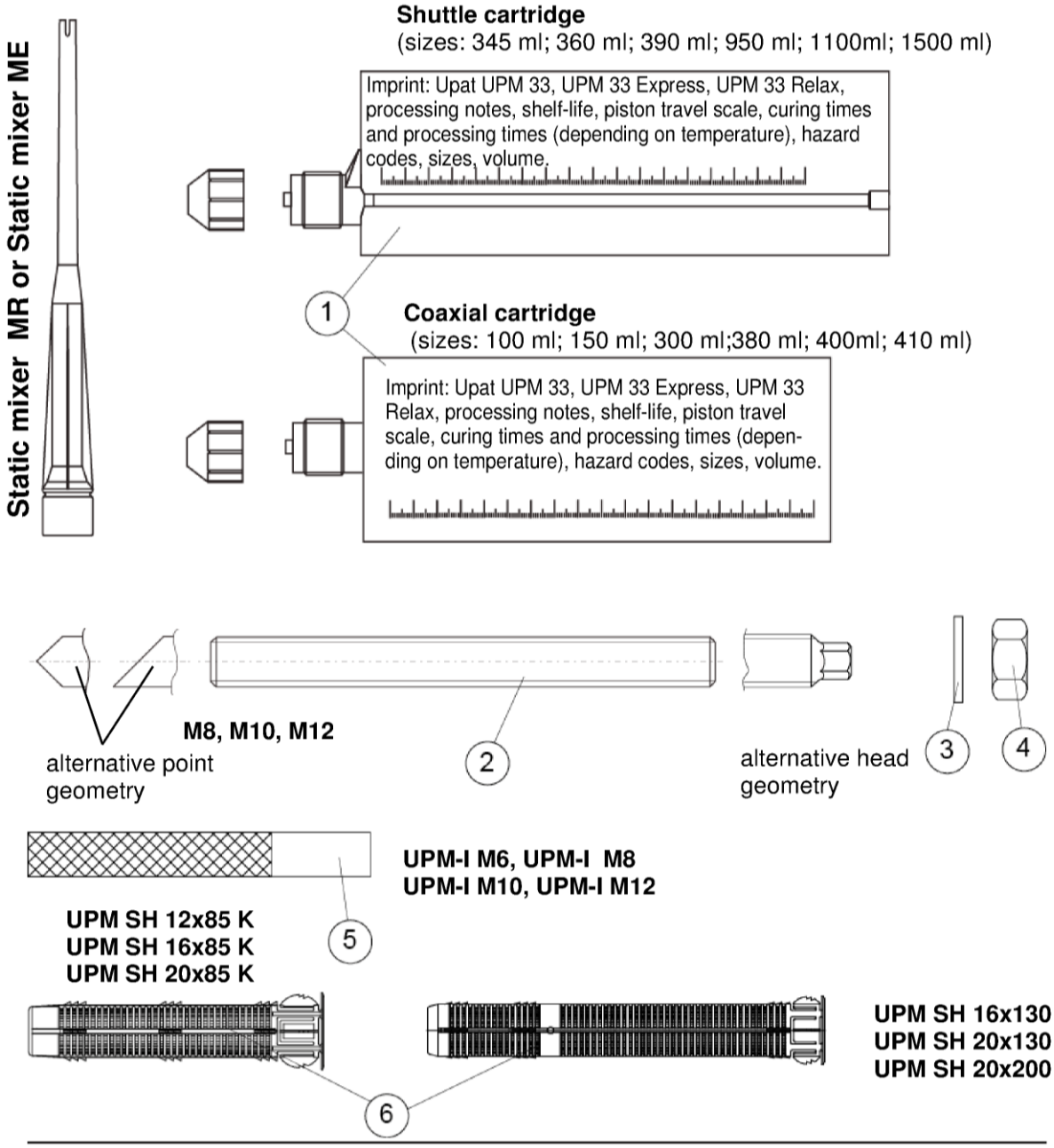
UPM-I M6
UPM-I M8
UPM-I M10
UPM-I M12

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

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

| Upat Injectionsystem UPM 33 for masonry | Annex A 2 |
|---|---|
| **Product description**<br>Installation condition, part 2: in solid brick masonry and aerated concrete | |

Deutsches Institut für Bautechnik DIBt




1. **Mortar cartridge**
2. **Threaded rod**
3. **Washer**
4. **Hexagon nut**
5. **Internal threaded anchor UPM-I**
6. **Perforated sleeve UPM SH K**

| | |
|---|---|
| **Upat Injectionsystem UPM 33 for masonry** | **Annex A 3** |
| **Product description**<br>Cartridges, anchor rods, internal threaded anchors, perforated sleeves | |

Deutsches Institut für Bautechnik DIBt

## Table A1: Materials

| Part | Designation | Material | | |
|---|---|---|---|---|
| 1 | Mortar cartridge | mortar, hardener; filler | | |
| | | Steel, zinc plated | Stainless steel A4 | High corrosion-resistant steel C |
| 2 | 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 $A_5 > 8\%$ | 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 $A_5 > 8\%$ | 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 $A_5 > 8\%$ |
| 3 | Washer ISO 7089:2000 | zinc plated ≥ 5µm, EN ISO 4042:1999 A2K or hot-dip galvanised 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 |
| 4 | 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 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 ISO 3506:2009 1.4565; 1.4529 EN 10088-1:2014 |
| 5 | Internal threaded anchor UPM I | Property class 5.8; EN 10277-1:2008 zinc plated ≥ 5µm, EN 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 |
| 6 | Perforated sleeve UPM SH K | PP / PE | | |

**Upat Injectionsystem UPM 33 for masonry**

**Product description**
Materials

**Annex A 4**

Deutsches Institut für Bautechnik DIBt

## Specifications of intended use part 1

**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 B8.
  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 B8
- Mortar strength class of the masonry M2,5 at minimum according to EN 998-2:2010
- For other bricks in solid masonry, 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 C6, Table C4

**Temperature Range:**

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

**Use conditions (Environmental conditions):**

- Dry and wet structure (regarding injection mortar)
- Structures subject to dry internal conditions exist
  (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
  (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 Injectionsystem UPM 33 for masonry | Annex B 1 |
|---|---|
| **Intended Use**<br>Specifications part 1 | |

Deutsches Institut für Bautechnik DIBt

## Specifications of intended use part 2

**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:**

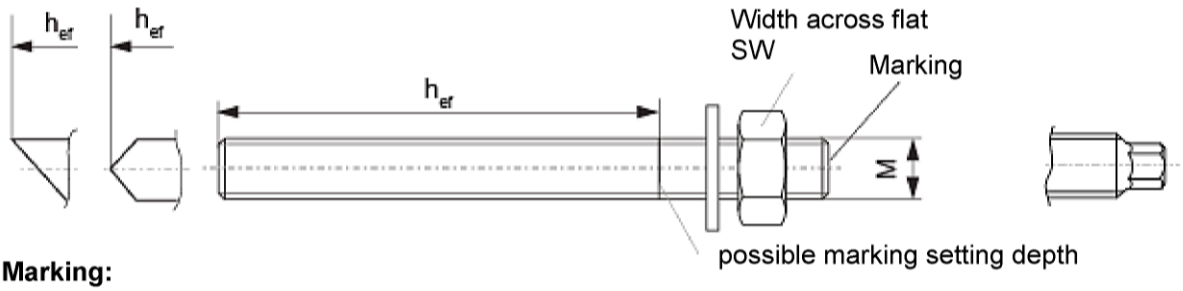
- Category d/d: -Installation and use in dry structures
- Category w/w: -Installation and use in dry and wet structures
- Hole drilling by hammer drill mode
- In case of aborted hole: The hole shall be filled with mortar
- Bridging of unbearing layer (e.g. plaster) see Annex B 4 (Table B1.3)
- Anchor 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 B3
- 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 Injectionsystem UPM 33 for masonry** | **Annex B 2** |
|---|---|
| **Intended Use**<br>Specifications part 2 | |




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

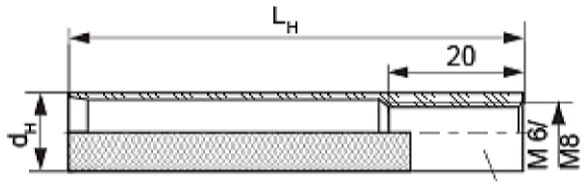
## Table B1.1: Installation parameters for threaded rod without perforated sleeve

| **Size** | | | | **M8** | **M10** | **M12** |
|---|---|---|---|---|---|---|
| Nominal drill hole diameter | | $d_{nom}=d_0$ | [mm] | 10 | 12 | 14 |
| Width across flat | | SW | [mm] | 13 | 17 | 19 |
| Effective anchorage depth[1)] | | $h_{ef,min}$ | [mm] | 50 | | |
| Depth of drill hole $h_0 = h_{ef}$ | | $h_{ef,max}$ | [mm] | h-30 and ≤ 200 mm | | |
| Effective anchorage depth AAC | | $h_{ef,min}$ | mm] | 100 | | |
| | | $h_{ef,max}$ | [mm] | 120 | | |
| Maximum torque moment | | $T_{inst,max}$ | [Nm] | 10 | | |
| Max. torque moment for autoclaved aerated concrete | | $T_{inst,max}$ | [Nm] | 1 | 2 | |
| Diameter of clearance hole in the fixture | Pre-position anchorage | $d_f \leq$ | [mm] | 9 | 12 | 14 |
| | Push through anchorage | $d_f \leq$ | [mm] | 11 | 14 | 16 |

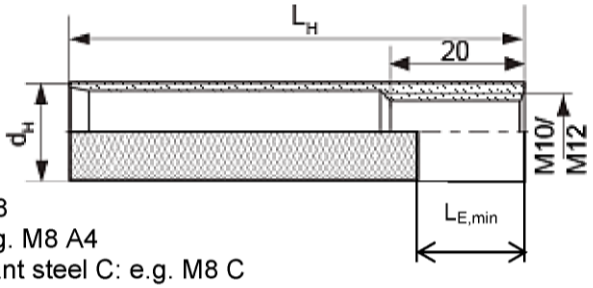
[1)] $h_{ef,min} \leq h_{ef} \leq h_{ef,max}$ is possible.

## 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

## Table B1.2: Installation parameters for internal threaded anchor UPM-I without perforated sleeve

| **Size UPM I** | | | **M6** | **M8** | **M10** | **M12** |
|---|---|---|---|---|---|---|
| diameter of internal threaded anchor | $d_H$ | [mm] | 11 | | 15 | |
| Nominal drill hole diameter | $d_{nom}=d_0$ | [mm] | 14 | | 18 | |
| Depth of drill hole | $h_0$ | [mm] | 85 | | | |
| Effective anchorage depth | $L_H=h_{ef}$ | [mm] | 85 | | | |
| Maximum torque moment | $T_{inst,max}$ | [Nm] | 4 | 10 | | |
| Max. torque moment for autoclaved aerated concrete | $T_{inst,max}$ | [Nm] | 1 | | 2 | |
| Diameter of clearance hole in the fixture | $d_f \leq$ | [mm] | 7 | 9 | 12 | 14 |
| Screw-in depth | $L_{E,min}$ | [mm] | 6 | 8 | 10 | 12 |

**Upat Injectionsystem UPM 33 for masonry**

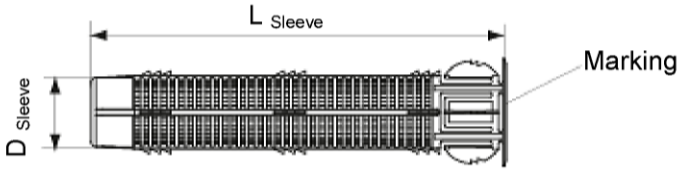
**Intended Use**
Installation parameters, part 1

**Annex B 3**

Deutsches Institut für Bautechnik DIBt

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

Marking:size
$D_{Sleeve}$ x $L_{Sleeve}$
e.g. 16x85




### Table B1.3: Installation parameters (threaded rod and internal threaded anchor with perforated sleeve; only pre-positioned anchorage)

| **Size UPM SH…K** | | | **12x85** | **16x85** | **16x130[2)]** | **20x85** | **20x130[2)]** | **20x200[2)]** |
|---|---|---|---|---|---|---|---|---|
| Nominal drill hole diameter ($d_0 = D_{Sleeve}$) | $d_{nom}=d_0$ | [mm] | 12 | 16 | | 20 | | |
| Depth of drill hole | $h_0$ | [mm] | 90 | 90 | 135 | 90 | 135 | 205 |
| Effective anchorage depth[1)] | $h_{ef,min}$ | [mm] | 85 | 85 | 110 | 85 | 110 | 180 |
| | $h_{ef,max}$ | [mm] | 85 | 85 | 130 | 85 | 130 | 200 |
| Size of threaded rod | | [-] | M8 | M8, M10 | | M12 | | |
| Size of internal threaded anchor | | [-] | ---- | 11x85 | ---- | 15x85 | ---- | ---- |
| Maximum torque moment threaded rod and internal threaded anchor | $T_{inst,max}$ | [mm] | 2 | | | | | |

[1)] $h_{ef,min} \le h_{ef} \le h_{ef,max}$ is possible.
[2)] Bridging of unbearing layer (e.g. plaster) possible

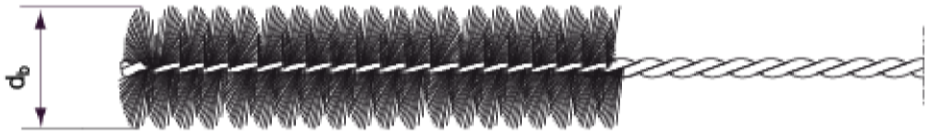
**Upat Injectionsystem UPM 33 for masonry**

**Intended Use**
Installation parameters, part 2.

**Annex B 4**

Deutsches Institut für Bautechnik DIBt

## Steel brush BS




Only for solid bricks and aerated concrete

## Table B2: Parameters of steel brush

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

## Table B3: Maximum processing time of the mortar and minimum curing time

(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] | | |
|---|---|---|---|
| | UPM 33 Express[3] | UPM 33[2] | UPM 33 Relax[2] |
| -10 to -5 | 12 hours | | |
| >-5 to ±0 | 3 hours | 24 hours | |
| >±0 to +5 | 90 | 3 hours | 6 hours |
| >+5 to +10 | 45 | 90 | 3 hours |
| >+10 to +20 | 30 | 60 | 2 hours |
| >+20 to +30 | | 45 | 60 |
| >+30 to +40 | | 35 | 30 |

| System-temperature (mortar) [ °C ] | Maximum processing time $t_{work}$ [minutes] | | |
|---|---|---|---|
| | UPM 33 Express[3] | UPM 33[2] | UPM 33 Relax[2] |
| | | | |
| ±0 | 5 | | |
| +5 | 5 | 13 | 20 |
| +10 | 3 | 9 | 20 |
| +20 | 1 | 5 | 10 |
| +30 | | 4 | 6 |
| +40 | | 2 | 4 |

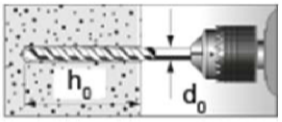
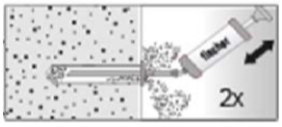
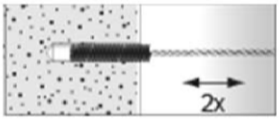
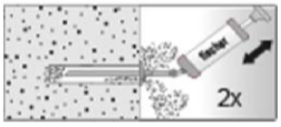
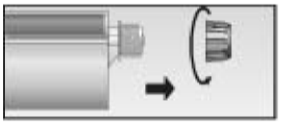
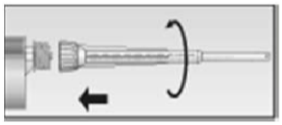
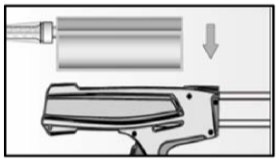
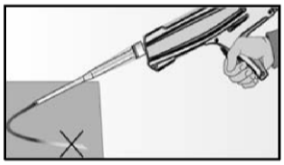
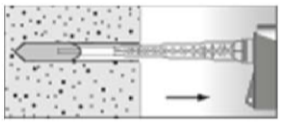
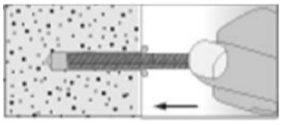
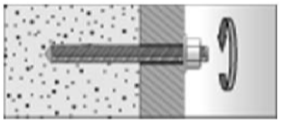
[1] For wet bricks the curing time must be doubled
[2] Minimum cartridge temperature +5°C
[3] Minimum cartridge temperature ±0°C

| Upat Injectionsystem UPM 33 for masonry | Annex B 5 |
|---|---|
| **Intended Use**<br>Steel brush<br>Processing times and curing times | |

Deutsches Institut für Bautechnik DIBt

## Installation instructions part 1

**Installation and Preparing the cartridge in solid brick and autoclaved aerated concrete (without perforated sleeve)**

| | | | | |
|---|---|---|---|---|
| 1 |   | Drill the hole. Depth of drill hole $h_0$ and drill hole diameter $d_0$ see Table **B1.1** or **B1.2** | | |
| 2 |   |   |   | Blow out the drill hole two times by hand. Brush the drill hole two times using an adequate steel brush (see Table B2) and blow out two times 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 material until the mortar is permanent-ly grey in colour. Mortar which is not grey in colour will not cure and must be disposed off. |
| 5 |  | Fill approximately 2/3 of the drill hole with mortar Always begin from the bottom of the hole to eliminate voids[1]. |  | For push through installation (not UPM-I) fill the annular gap also with mortar. |
| 6 |  | Only use clean and oil-free anchor elements. Mark the threaded rod for setting depth. Press the threaded rod or internal threaded anchor UPM-I down to the bottom of the hole, turning it slightly by hand while doing. After inserting the anchor element, excess mortar must emerge around the anchor element. | | |
| 7 |  | Wait for the specified curing time $t_{cure}$ see Table **B3** |  | Mounting the fixture $T_{inst,max}$ see Table **B1.1** or **B1.2** |

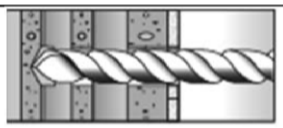
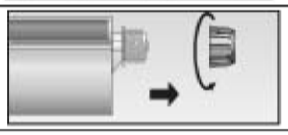
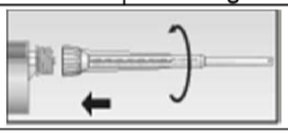
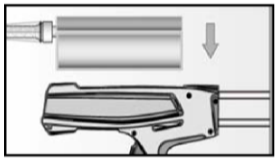
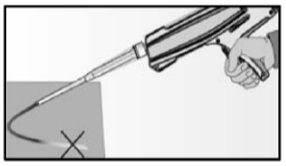
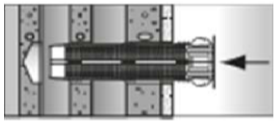
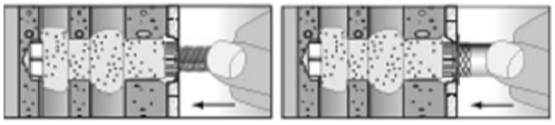
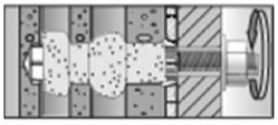
[1] For the exact quantity of mortar see manufacturer`s specification.

| | |
|---|---|
| **Upat Injectionsystem UPM 33 for masonry** | **Annex B 6** |
| **Intended Use**<br>Installation instructions part 1 in solid brick and aerated concrete | |

Deutsches Institut für Bautechnik DIBt

## Installation instructions part 2

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

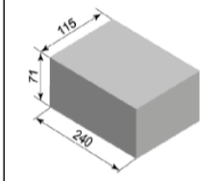
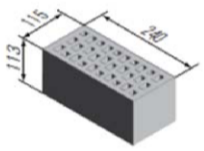
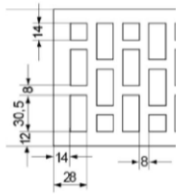
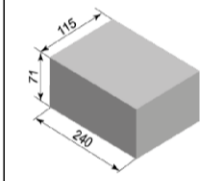
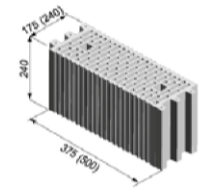
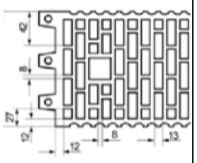
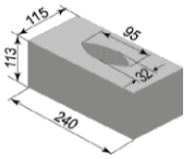
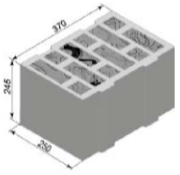
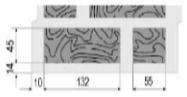
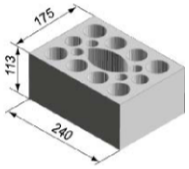
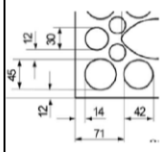
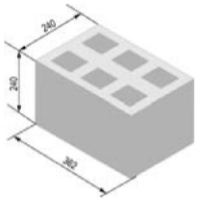
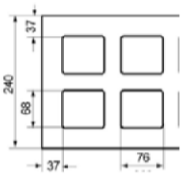
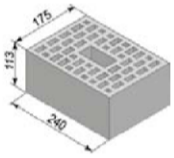
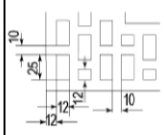
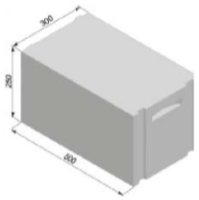
| | | | | |
|---|---|---|---|---|
| 1 |  | Drill the hole. Depth of drill hole $h_0$ and drill hole diameter $d_0$ see Table **B1.3** | When install perforated sleeves in solid bricks or solid areas of hollow bricks, also clean the hole by blowing out and brushing | |
| 2 |  | Remove the sealing cap |  | 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 material until the mortar is permanent-ly grey in colour. Mortar which is not grey in colour will not cure and must be disposed off |
| 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 |  | Wait for the specified curing time $t_{cure}$ see Table **B3** |  | Mounting the fixture. $T_{inst,max}$ see Table B1.3 |

[1)] For the exact quantity of mortar see manufacturer`s specification.

| | |
|---|---|
| **Upat Injectionsystem UPM 33 for masonry** | **Annex B 7** |
| **Intended Use**<br>Installation instructions part 2 in hollow brick masonry | |

Deutsches Institut für Bautechnik DIBt

## Table B 4: Summary of bricks and blocks

| | | | | | |
|---|---|---|---|---|---|
| **Brick No. 1**<br>Solid brick Mz according to EN 771-2<br>ρ ≥ 1,8 [kg/dm³]<br>fb ≥ 10 or 20 [N/mm²] |  | | **Brick No. 6**<br>Perforated brick HLz according to EN 771-1<br>ρ ≥ 1,4 [kg/dm³]<br>fb ≥ 20 [N/mm²] |  |  |
| **Brick No. 2**<br>Solid sand-lime brick according to EN 771-2<br>ρ ≥ 1,8 [kg/dm³]<br>fb ≥ 10 or 20 [N/mm²] |  | | **Brick No. 7**<br>Perforated brick HLz according to EN 771-1<br>ρ ≥ 1,0 [kg/dm³]<br>fb ≥ 10 [N/mm²] |  |  |
| **Brick No. 3**<br>Solid sand-lime brick according to EN 771-2<br>ρ ≥ 1,8 [kg/dm³]<br>fb ≥ 10 or 20 [N/mm²] |  | | **Brick No. 8**<br>Perforated brick HLz filled with mineral wool according to EN 771-1<br>ρ ≥ 0,6 [kg/dm³]<br>fb ≥ 8 [N/mm²] |  |  |
| **Brick No. 4**<br>Sand-lime hollow brick according to EN 771-2<br>ρ ≥ 1,4 [kg/dm³]<br>fb ≥ 12 or 20 [N/mm²] |  |  | **Brick-No. 9**<br>Light-weight concrete hollow block **Hbl** according to EN 771-1<br>ρ ≥ 1,0 [kg/dm³]<br>fb ≥ 4 [N/mm²] |  |  |
| **Brick No. 5**<br>Perforated brick HLz according to EN 771-1<br>ρ ≥ 0,9 [kg/dm³]<br>fb ≥ 10 [N/mm²] |  |  | **Brick No. 10**<br>Autoclaved aerated concrete block<br>ρ ≥ 350, 500 or 650 [kg/dm³]<br>fb ≥ 2, 4 or 6 [N/mm²] |  | |

Imaging of the bricks are not scaled

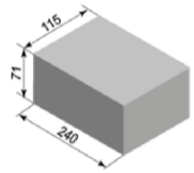
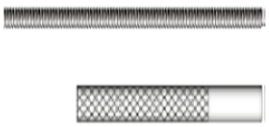
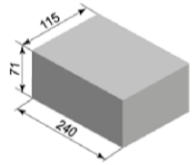
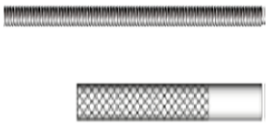
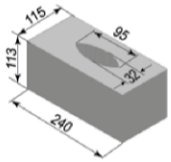
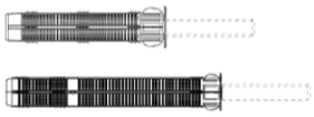
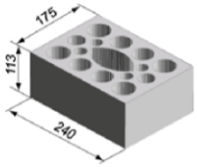
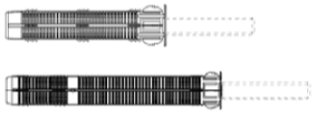
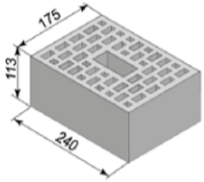
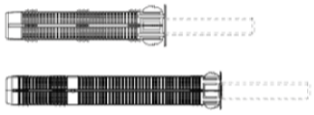
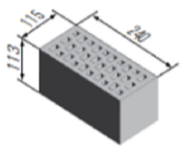
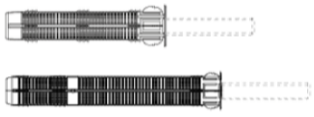
**Upat Injectionsystem UPM 33 for masonry**

**Intended Use**
Types and dimensions of blocks and bricks

**Annex B 8**

Deutsches Institut für Bautechnik DIBt

## Table B5.1: Allocation of anchor rods[1], perforated sleeves[1)2)] and perforated or solid bricks

| Kind of masonry | Brick | Valid anchor rods and perforated sleeves | |
|---|---|---|---|
| **Brick No. 1**<br>Solid brick Mz according to EN 771-2<br>ρ ≥ 1,8 [kg/dm³]<br>fb ≥ 10 or 20 [N/mm²] |  |  | M8; M10; M12<br>UPM-I M6, M8 |
| **Brick No. 2**<br>Solid sand-lime brick according to EN 771-2<br>ρ ≥ 1,8 [kg/dm³]<br>fb ≥ 10 or 20 [N/mm²] |  |  | M8; M10; M12<br>UPM-I M6, M8 |
| **Brick No. 3**<br>Solid sand-lime brick according to EN 771-2<br>ρ ≥ 1,8 [kg/dm³]<br>fb ≥ 10 or 20 [N/mm²] |  |  | UPM SH 12x85 K<br>UPM SH 16x85 K<br>UPM SH 20x85 K<br>UPM SH 16x130 K<br>UPM SH 20x130 K |
| **Brick No. 4**<br>Sand-lime hollow brick according to EN 771-2<br>ρ ≥ 1,4 [kg/dm³]<br>fb ≥ 12 or 20 [N/mm²] |  |  | UPM SH 12x85 K<br>UPM SH 16x85 K<br>UPM SH 20x85 K<br>UPM SH 16x130 K<br>UPM SH 20x130 K |
| **Brick No. 5**<br>Perforated brick HLz according to EN 771-1<br>ρ ≥ 0,9 [kg/dm³]<br>fb ≥ 10 [N/mm²] |  |  | UPM SH 12x85 K<br>UPM SH 16x85 K<br>UPM SH 20x85 K<br>UPM SH 16x130 K<br>UPM SH 20x130 K |
| **Brick No. 6**<br>Perforated brick HLz according to EN 771-1<br>ρ ≥ 1,4 [kg/dm³]<br>fb ≥ 20 [N/mm²] |  |  | UPM SH 12x85 K<br>UPM SH 16x85 K<br>UPM SH 20x85 K |

[1)] Other combinations can be used after job site tests acc. to ETAG 029, Annex B.
[2)] Sleeve/anchor rod combination see table B1.3

The β- factor for this job site tests are given in Table C4
Imaging of the bricks are not scaled

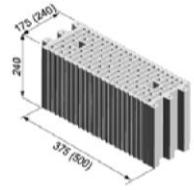
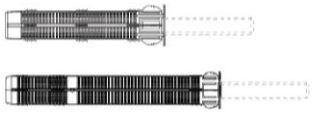
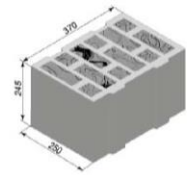
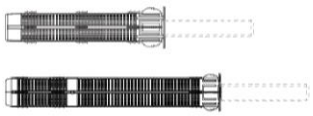
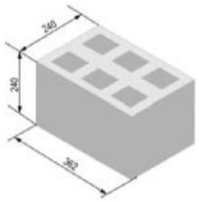
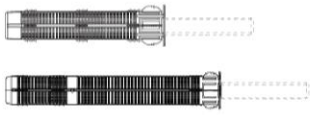
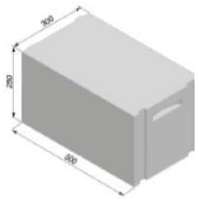
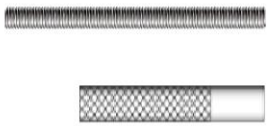
**Upat Injectionsystem UPM 33 for masonry**

**Intended Use**
Allocation of anchor rods, perforated sleeves and bricks, part 1

**Annex B 9**

Deutsches Institut für Bautechnik DIBt

## Table B5.2: Allocation of anchor rods[1], perforated sleeves[1)2)] and perforated or solid bricks

| Kind of masonry | Brick | Valid anchor rods and perforated sleeves | |
|---|---|---|---|
| **Brick No. 7**<br>Perforated brick HLz according to EN 771-1<br>ρ ≥ 1,0 [kg/dm³]<br>fb ≥ 10 [N/mm²] |  |  | UPM SH 12x85 K<br>UPM SH 16x85 K<br>UPM SH 20x85 K<br>UPM SH 20x130 K |
| **Brick No. 8**<br>Perforated brick HLz filled with mineral wool according to EN 771-1<br>ρ ≥ 0,6 [kg/dm³]<br>fb ≥ 8 [N/mm²] |  |  | UPM SH 12x85 K<br>UPM SH 16x85 K<br>UPM SH 20x85 K<br>UPM SH 16x130 K<br>UPM SH 20x130 K<br>UPM SH 20x200 K |
| **Brick-No. 9**<br>Light-weight concrete hollow block Hbl according to EN 771-1<br>ρ ≥ 1,0 [kg/dm³]<br>fb ≥ 4 [N/mm²] |  |  | UPM SH 12x85 K<br>UPM SH 16x85 K<br>UPM SH 20x85 K<br>UPM SH 16x130 K<br>UPM SH 20x130 K |
| **Brick No. 10**<br>Autoclaved aerated concrete block<br>ρ ≥ 350, 500 or 650 [kg/dm³]<br>fb ≥ 2, 4 or 6 [N/mm²] |  |  | M8; M10; M12<br>UPM-I M6<br>UPM-I M8<br>UPM-I M10<br>UPM-I M12 |

[1)] Other combinations can be used after job site tests acc. to ETAG 029, Annex B.
[2)] Sleeve/anchor rod combination see table B1.3

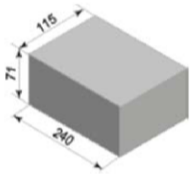
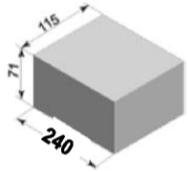
The β- factor for this job site tests are given in Table C4

Imaging of the bricks are not scaled

| | |
|---|---|
| **Upat Injectionsystem UPM 33 for masonry** | **Annex B 10** |
| **Intended Use**<br>Allocation of anchor rods, perforated sleeves and bricks, part 2 | |

Deutsches Institut für Bautechnik DIBt

## Table C1.1: Characteristic values of resistance under tension loads and under shear loads

| Brick | Density ρ [kg/dm³] - Compressive strength $f_b$ [N/mm²] | Perforated sleeve UPM SH…K | Anchor size or screw size in internal threaded anchor | Effective anchorage depth | | Characteristic resistance [kN] | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | $N_{Rk}$ | | $V_{Rk}$ |
| | | | | | | Temp. 50/80°C | | All categories |
| | | | | $h_{ef,min}$ [mm] | $h_{ef,max}$ [mm] | d/d | w/w | |
|  **No.1** Solid brick Mz | ρ ≥ 1,8 $f_b$ ≥ 10 | without | M8 | 50 | 200 | 4,0 | 2,5 | 2,5 |
| | | | M10 | 50 | 79 | 3,5 | 2,0 | 4,0 |
| | | | M10 | 80 | 199 | 5,0 | 3,0 | |
| | | | M10 | 200 | 200 | 8,5 | 7,5 | 8,5 |
| | | | M12 | 50 | 79 | 3,0 | 2,0 | 4,0 |
| | | | M12 | 80 | 199 | 5,5 | 3,5 | |
| | | | M12 | 200 | 200 | 8,0 | 5,0 | 8,5 |
| | | | UPM-I M6/ M8 | 85 | 85 | 5,5 | 3,5 | 2,5 |
| | ρ ≥ 1,8 $f_b$ ≥ 20 | | M8 | 50 | 200 | 5,5 | 3,5 | 4,0 |
| | | | M10 | 50 | 79 | 5,0 | 3,0 | 6,0 |
| | | | M10 | 80 | 199 | 7,0 | 4,5 | |
| | | | M10 | 200 | 200 | 8,5 | 8,5 | 8,5 |
| | | | M12 | 50 | 79 | 4,5 | 3,0 | 5,5 |
| | | | M12 | 80 | 199 | 8,0 | 5,0 | |
| | | | M12 | 200 | 200 | 8,5 | 7,0 | 8,5 |
| | | | UPM-I M6/ M8 | 85 | 85 | 8,0 | 5,0 | 4,0 |
|  **No.2** Solid sand-lime brick | ρ ≥ 1,8 $f_b$ ≥ 10 | without | M8 | 50 | 200 | 2,5 | 1,5 | 4,0 |
| | | | M10 | 50 | 79 | | | |
| | | | M10 | 80 | 199 | | | |
| | | | M10 | 200 | 200 | 8,5 | 6,0 | |
| | | | M12 | 50 | 79 | 2,5 | 1,5 | 5,0 |
| | | | M12 | 80 | 199 | | | |
| | | | M12 | 200 | 200 | 8,5 | 6,5 | |
| | | | UPM-I M6/ M8 | 85 | 85 | 2,5 | 1,5 | 3,0 |
| | ρ ≥ 1,8 $f_b$ ≥ 20 | | M8 | 50 | 200 | 3,5 | 2,0 | 5,5 |
| | | | M10 | 50 | 79 | | | |
| | | | M10 | 80 | 199 | | | |
| | | | M10 | 200 | 200 | 8,5 | 8,5 | |
| | | | M12 | 50 | 79 | 3,5 | 2,0 | 7,0 |
| | | | M12 | 80 | 199 | | | |
| | | | M12 | 200 | 200 | 8,5 | 8,5 | |
| | | | UPM-I M6/ M8 | 85 | 85 | 3,5 | 2,0 | 4,0 |

Imaging of the bricks are not scaled

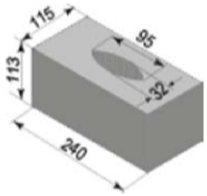
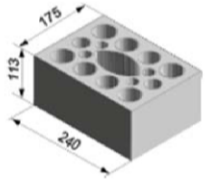
**Upat Injectionsystem UPM 33 for masonry**

**Annex C 1**

**Performances**
Characteristic values of resistance under tension loads and under shear loads, part 1

Deutsches Institut für Bautechnik DIBt

## Table C1.2: Characteristic values of resistance under tension loads and under shear loads

| Brick | Density ρ [kg/dm³] - Compressive strength $f_b$ [N/mm²] | Perforated sleeve UPM SH…K | Anchor size or screw size in internal threaded anchor | Effective anchorage depth | | Characteristic resistance [kN] | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | $N_{Rk}$ | | $V_{Rk}$ |
| | | | | | | Temp. 50/80°C | | All categories |
| | | | | $h_{ef,min}$ [mm] | $h_{ef,max}$ [mm] | d/d | w/w | |
|  **No.3** Solid sand-lime brick | ρ ≥ 1,8 $f_b$ ≥ 10 | 12x85 | M8 | 85 | 85 | 6,0 | 3,5 | 3,0 |
| | | 16x85 | UPM-I M6 | 85 | 85 | 3,5 | 2,0 | |
| | | 16x85 | M8/M10, UPM-I M8 | 85 | 85 | 3,5 | 2,0 | 3,5 |
| | | 20x85 | M12, UPM-I M10/M12 | 85 | 85 | 8,5 | 6,5 | |
| | | 16x130 | M8/M10 | 110 | 130 | 3,5 | 2,0 | |
| | | 20x130 | M12 | 110 | 130 | 7,0 | 4,5 | |
| | ρ ≥ 1,8 $f_b$ ≥ 20 | 12x85 | M8 | 85 | 85 | 8,5 | 5,0 | 4,5 |
| | | 16x85 | UPM-I M6 | 85 | 85 | 5,5 | 3,0 | |
| | | 16x85 | M8/M10, UPM-I M8 | 85 | 85 | 5,5 | 3,0 | 5,5 |
| | | 20x85 | M12, UPM-I M10/M12 | 85 | 85 | 8,5 | 8,5 | |
| | | 16x130 | M8/M10 | 110 | 130 | 5,0 | 3,0 | |
| | | 20x130 | M12 | 110 | 130 | 8,5 | 6,0 | |
|  **No.4** Sand-lime hollow brick | ρ ≥ 1,4 $f_b$ ≥ 12 | 12x85 | M8 | 85 | 85 | 2,5 | 2,5 | 2,5 |
| | | 16x85 | UPM-I M6 | 85 | 85 | 3,0 | 2,5 | |
| | | 16x85 | M8/M10, UPM-I M8 | 85 | 85 | 3,0 | 2,5 | 4,5 |
| | | 20x85 | M12, UPM-I M10/M12 | 85 | 85 | 3,5 | 3,0 | 4,5 |
| | | 16x130 | M8/M10 | 110 | 130 | | | |
| | | 20x130 | M12 | 110 | 130 | | | |
| | ρ ≥ 1,4 $f_b$ ≥ 20 | 12x85 | M8 | 85 | 85 | 4,5 | 4,0 | 4,5 |
| | | 16x85 | UPM-I M6 | 85 | 85 | 5,0 | 4,0 | 4,0 |
| | | 16x85 | M8/M10, UPM-I M8 | 85 | 85 | 5,0 | 4,5 | 7,5 |
| | | 20x85 | M12, UPM-I M10/M12 | 85 | 85 | 6,0 | 5,5 | 7,5 |
| | | 16x130 | M8/M10 | 110 | 130 | | | |
| | | 20x130 | M12 | 110 | 130 | | | |

Imaging of the bricks are not scaled

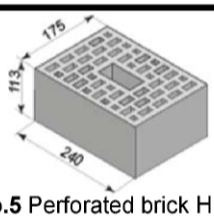
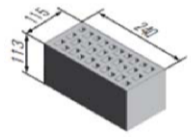
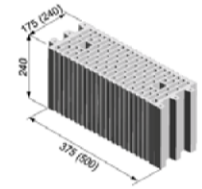
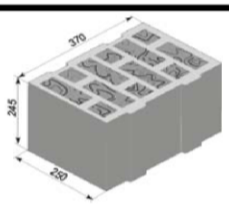
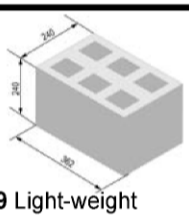
**Upat Injectionsystem UPM 33 for masonry**

**Annex C 2**

**Performances**
Characteristic values of resistance under tension loads and under shear loads, part 2

Deutsches Institut für Bautechnik DIBt

## Table C1.3: Characteristic values of resistance under tension loads and under shear loads

| Brick | Density ρ [kg/dm³] - Compressive strength $f_b$ [N/mm²] | Perforated sleeve UPM SH…K | Anchor size or screw size in internal threaded anchor | Effective anchorage depth | | Characteristic resistance [kN] | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | $N_{Rk}$ | | $V_{Rk}$ |
| | | | | | | Temp. 50/80°C | | All categories |
| | | | | $h_{ef,min}$ [mm] | $h_{ef,max}$ [mm] | d/d | w/w | |
|  **No.5** Perforated brick HLz | ρ ≥ 0,9 $f_b$ ≥ 10 | 12x85 | M8 | 85 | 85 | 4,0 | 3,5 | 4,0 |
| | | 16x85 | UPM-I M6 | 85 | 85 | 3,5 | 3,5 | 4,0 |
| | | 16x85 | M8/M10, UPM-I M8 | 85 | 85 | 3,5 | 3,5 | 5,5 |
| | | 20x85 | M12, UPM-I M10/M12 | 85 | 85 | 5,0 | 4,5 | 6,0 |
| | | 16x130 | M8/M10 | 130 | 130 | 5,0 | 4,5 | 5,5 |
| | | 20x130 | M12 | 110 | 130 | 5,0 | 4,5 | 6,0 |
|  **No.6** Perforated brick HLz | ρ ≥ 1,4 $f_b$ ≥ 20 | 12x85 | M8 | 85 | 85 | 4,0 | 3,5 | 7,5 (5,5)[1] |
| | | 16x85 | UPM-I M6 | 85 | 85 | 2,5 | | 4,0 |
| | | 16x85 | M8/M10, UPM-I M8 | 85 | 85 | 2,5 | | 4,5 |
| | | 20x85 | M12, UPM-I M10/M12 | 85 | 85 | 3,0 | | 8,5 (5,5)[1] |
|  **No.7** Perforated brick HLz | ρ ≥ 1,0 $f_b$ ≥ 10 | 12x85 | M8 | 85 | 85 | 0,9 | | 1,2 |
| | | 16x85 | M8/M10, UPM-I M6/M8 | 85 | 85 | 2,5 | | |
| | | 20x85 | M12, UPM-I M10/M12 | 85 | 85 | | | |
| | | 16x130 | M8/M10 | 110 | 130 | | | 1,5 |
| | | 20x130 | M12 | 110 | 130 | 3,5 | 3,0 | 1,5 |
|  **No.8** Perforated brick HLz | ρ ≥ 0,6 $f_b$ ≥ 8 | 12x85 | M8 | 85 | 85 | 2,0 | 2,0 | 2,5 |
| | | 16x85 | UPM-I M6 | 85 | 85 | 2,0 | 1,5 | 2,5 |
| | | 16x85 | M8/M10, UPM-I M8 | 85 | 85 | 2,0 | 1,5 | 3,0 |
| | | 20x85 | M12, UPM-I M10/M12 | 85 | 85 | 2,0 | 2,0 | 1,5 |
| | | 16x130 | M8/M10 | 130 | 130 | 3,0 | 2,5 | 3,0 |
| | | 20x130 | M12 | 110 | 130 | 2,0 | 2,0 | 1,5 |
| | | 20x200 | M12 | 180 | 200 | 3,0 | 3,0 | 1,5 |
|  **No.9** Light-weight concrete hollow block | ρ ≥ 1,0 $f_b$ ≥ 4 | 12x85 | M8 | 85 | 85 | 3,0 | | 2,0 |
| | | 16x85 | M8/M10, UPM-I M6/M8 | 85 | 85 | | | |
| | | 20x85 | M12, UPM-I M10/M12 | 85 | 85 | | | |
| | | 16x130 | M8/M10 | 130 | 130 | | | |
| | | 20x130 | M12 | 110 | 130 | | | |

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

Imaging of the bricks are not scaled

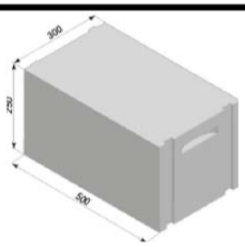
**Upat Injectionsystem UPM 33 for masonry**

**Performances**
Characteristic values of resistance under tension loads and under shear loads, part 3

**Annex C 3**

Deutsches Institut für Bautechnik DIBt

## Table C1.4: Characteristic values of resistance under tension loads and under shear loads

| Brick | Density ρ [kg/dm³] - Compressive strength $f_b$ [N/mm²] | Perforated sleeve UPM SH…K | Anchor size or screw size in internal threaded anchor | Effective anchorage depth | | Characteristic resistance [kN] | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | $N_{Rk}$ | | $V_{Rk}$ |
| | | | | | | Temp. 50/80°C | | All categories |
| | | | | $h_{ef,min}$ [mm] | $h_{ef,max}$ [mm] | d/d | w/w | |
|  **No.10** Aerated concrete block | ρ ≥ 350 $f_b$ ≥ 2 | ohne | M8 | 100 | 120 | 1,5 | | 1,2 |
| | | | M10 | 100 | 120 | | | 1,2 |
| | | | M12 | 100 | 120 | | | 1,5 |
| | | | UPM-I M6/M8 UPM-I M10/M12 | 85 | | | | 1,2 |
| | ρ ≥ 500 $f_b$ ≥ 4 | ohne | M8 | 100 | 120 | 2,0 | | 2,5 |
| | | | M10 | 100 | 120 | 2,5 | | 2,0 |
| | | | M12 | 100 | 120 | | | 2,5 |
| | | | UPM-I M6/M8 UPM-I M10/M12 | 85 | | 2,0 | | 2,0 |
| | ρ ≥ 650 $f_b$ ≥ 6 | ohne | M8 | 100 | 120 | 3,5 | 3,0 | 3,0 |
| | | | M10 | 100 | 120 | 5,0 | 4,5 | 3,0 |
| | | | M12 | 100 | 120 | | | 3,5 |
| | | | UPM-I M6/M8 UPM-I M10/M12 | 85 | | 3,5 | | 2,5 |

Imaging of the bricks are not scaled

**Upat Injectionsystem UPM 33 for masonry**

**Performances**
Characteristic values of resistance under tension loads and under shear loads, part 4

**Annex C 4**

Deutsches Institut für Bautechnik DIBt

## Table C2: Characteristic bending moments

| Größe | | | | M8 | M10 | M12 |
|---|---|---|---|---|---|---|
| Characteristic bending moment $M_{Rk,s}$ | Zinc-plated steel | Property class | 5.8 [Nm] | 19 | 37 | 65 |
| | | | 8.8 [Nm] | 30 | 60 | 105 |
| | Stainless steel A4 | Property class | 50 [Nm] | 19 | 37 | 65 |
| | | | 70 [Nm] | 26 | 52 | 92 |
| | | | 80[Nm] | 30 | 60 | 105 |
| | High corrosion-resistant steel C | Property class | 50 [Nm] | 19 | 37 | 65 |
| | | | 70[1)] [Nm] | 26 | 52 | 92 |
| | | | 80 [Nm] | 30 | 60 | 105 |

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

## Table C2.1: 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 |

## Tabelle C3: Displacements under tension loads and shear loads

| Material | N [kN] | $\delta N_0$ [mm] | $\delta N_\infty$ [mm] | V [kN] | $\delta V_0$ [mm] | $\delta V_\infty$ [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 |

**Upat Injectionsystem UPM 33 for masonry**

**Performances**
Characteristic bending moments; displacements

**Annex C 5**

Deutsches Institut für Bautechnik DIBt

## Table C4: β- factor for job site tests according to ETAG 029, Annex B

| Using categories | | w/w | d/d |
|---|---|---|---|
| Temperature range [°C] | | 50/80 | 50/80 |
| Brick | Size[1)] | | |
| Solid brick | M8 | 0,57 | 0,96 |
| | M10 | 0,59 | |
| | M12<br>UPM I 11x85<br>UPM I 15x85 | 0,60 | |
| Hollow brick | All sizes | 0,86 | 0,96 |
| Autoclaved aerated concrete | All size | 0,73 | 0,81 |

**Upat Injectionsystem UPM 33 for masonry**

**Performances**
β- factors for job site tests

**Annex C 6**

Deutsches Institut für Bautechnik DIBt

## Table C5: Edge distance and spacing (installation with and without sleeves)

| Direction to bed joint | | | ⊥ | | ∥ | | Group factor | | | | Min. thickness of the masonry members |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Brick No. | $h_{ef}$ [mm] | $c_{cr} = c_{min}$ | $s_{min}$ | $s_{cr}$ | $s_{min}$ | $s_{cr}$ | ⊥ | | ∥ | | |
| | | [mm] | [mm] | [mm] | [mm] | [mm] | $\alpha_{g,N}$ | $\alpha_{g,V}$ | $\alpha_{g,N}$ | $\alpha_{g,V}$ | [mm] |
| 1 | 50 | 100 | 75 | | 60[1] | 150 | 2 | 2 | 1,5 | 1,4 | $h_{ef}$ + 30 (≥ 80) |
| | 80 | 100 | 75 | | 60[1] | 240 | 2 | 2 | 1,5 | 1,4 | |
| | 200 | 150 | 75 | | 240 | | 2 | | | | |
| 2 | 50 | 100 | 75 | | 240 | | 2 | | | | |
| | 80 | 100 | 75 | | 240 | | 2 | | | | |
| | 200 | 150 | 75 | | 240 | | 2 | | | | |
| 3 | 85 | 100 | 115 | | 240 | | 2 | | | | |
| | 130 | 100 | 115 | | 240 | | 2 | | | | |
| 4 | all sizes | 100 | 115 | | 100 | 240 | 2 | 2 | 1,5 | 1,5 | |
| 5 | all sizes | 100 | 115 | | 240 | | 2 | | | | |
| 6 | all sizes | 100 | 115 | | 240 | | 2 | | | | |
| 7 | all sizes | 100 | 100 | 240 | 100 | 375 (500)[2] | 1 | 1 | 1 | 1 | |
| 8 | all sizes | 120 | 245 | | 250 | | 2 | | | | |
| 9 | all sizes | 80 | 240 | | 365 | | 2 | | | | |
| 10 | all sizes | 100 | 250 | | 300 | | 2 | | | | |

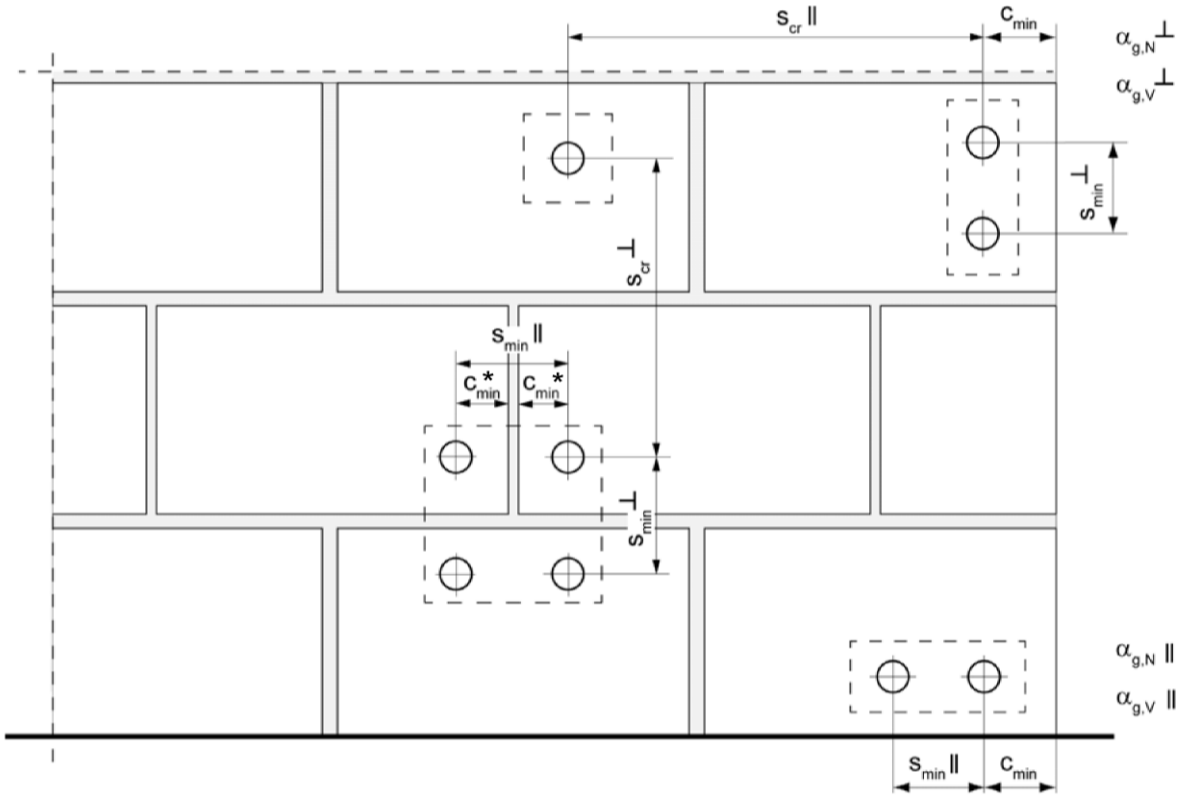
[1] only valid for tension loads, for shear loads $s_{min}\| = s_{cr}\|$
[2] spacing depending on brick dimension, brick dimension see table B4, brick 7

**Upat Injectionsystem UPM 33 for masonry**

**Performances**
Edge distance and spacing

**Annex C 7**

Deutsches Institut für Bautechnik DIBt




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

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

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

For $s_{min} \leq s \leq s_{cr}$ $\alpha_g$ according to table C5

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

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

| | |
|---|---|
| **Upat Injectionsystem UPM 33 for masonry** | **Annex C 8** |
| **Performance**<br>Definition of minimum edge distance, minimum spacing and group factors | |