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

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European Technical Assessment

ETA-17/1055 of 14/12/2017

General Part

Technical Assessment Body issuing the European Technical Assessment	Instytut Techniki Budowlanej
Trade name of the construction product	TYTAN PROFESSIONAL Evolution I Universal Injection Anchor (TP II) TYTAN PROFESSIONAL Evolution I Universal Injection Anchor Standard (TP II-S) TYTAN PROFESSIONAL Evolution I Universal Injection Anchor Winter (TP II-W)
Product family to which the construction product belongs	Injection anchors for use in masonry
Manufacturer	SELENA S.A. ul. Wyścigowa 56E 53-012 Wrocław Poland
Manufacturing plant	Manufacturing Plant No. 3
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 "Metal injection anchor for use in masonry", ETAG 029, Edition April 2013, used as European Assessment Document (EAD)

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Specific Part

1 Technical description of the product

The injection system TYTAN PROFESSIONAL Evolution I Universal Injection Anchor (TP II), TYTAN PROFESSIONAL Evolution I Universal Injection Anchor Standard (TP II-S) and TYTAN PROFESSIONAL Evolution I Universal Injection Anchor Winter (TP II-W) are a bonded anchors (injection type) consisting of a injection mortar cartridge, a perforated sleeve and an anchor rod with hexagon nut and washer. Anchor rods are made of galvanized carbon steel, stainless steel or high corrosion resistant stainless steel.

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

An illustration and the description of the products are given in Annex A.

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

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

The performances given in this European Technical Assessment are based on an assumed working life of the anchor of 50 years. The indications given on the working life cannot be interpreted as a guarantee given by the producer or the Technical Assessment Body, 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 Performance of the product

3.1.1 Mechanical resistance and stability (BWR 1)

Essential characteristic	Performance
Characteristic resistance for tension and shear loads	Annexes C1 to C4
Characteristic resistance for bending moments	Annex C4
Displacements under shear and tension loads	Annexes C5 to C8
Reduction factor for job site tests (β-Factor)	Annex C9
Edge distance and spacing	Annex C9

3.1.2 Safety in case of fire (BWR 2)

No performance assessed.

3.1.3 Hygiene, health and the environment (BWR 3)

Regarding the dangerous substances clauses contained in this European Technical Assessment, there may be requirements applicable to the products falling within its scope (e.g. transposed European legislation and national laws, regulations and administrative provisions). In order to meet the provisions of the Construction Products Regulation, these requirements need also to be complied with, when and where they apply.

3.1.4 Safety in use (BWR 4)

For Basic Requirement Safety in use the same criteria are valid as for Basic Requirement Mechanical resistance and stability (BWR 1).

3.1.5 Sustainable use of natural resources (BWR 7)

No performance assessed.

3.1.6 General aspects relating to fitness for use

Durability and serviceability are only ensured if the specifications of intended use according to Annex B1 are kept.

3.2 Methods used for the assessment

The assessment of fitness of the anchors for the declared, intended use in relation to the requirements for mechanical resistance and stability and safety in use in the sense of Basic Requirements 1 and 4 has been made in accordance with the ETAG 029 *"Metal injection anchor for use in masonry"*.

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

According to Decision 97/177/EC of the European Commission the system of assessment and verification of constancy of performance (see Annex V to Regulation (EU) No 305/2011) given in the following table applies.

Product	Intended use	Level or class	System
Metal injection anchors for use in masonry	Fixing and/or support to masonry, structural elements (which contribute to the stability of the works) or heavy units such as cladding as well as installation	–	1

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

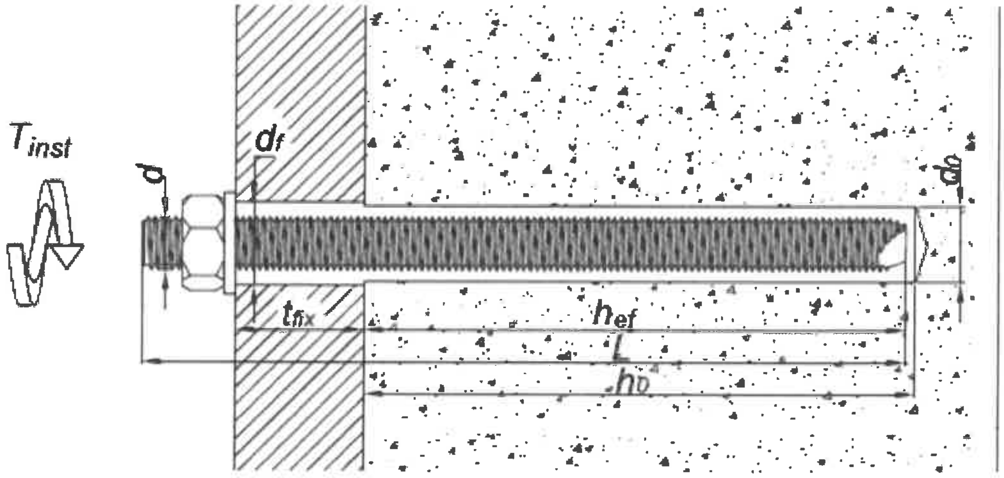
Technical details necessary for the implementation of the AVCP system are laid down in the control plan which is deposited at Instytut Techniki Budowlanej.

For type testing the results of the tests performed as part of the assessment for the European Technical Assessment shall be used unless there are changes in the production line or plant. In such cases the necessary type testing has to be agreed between Instytut Techniki Budowlanej and the notified body.

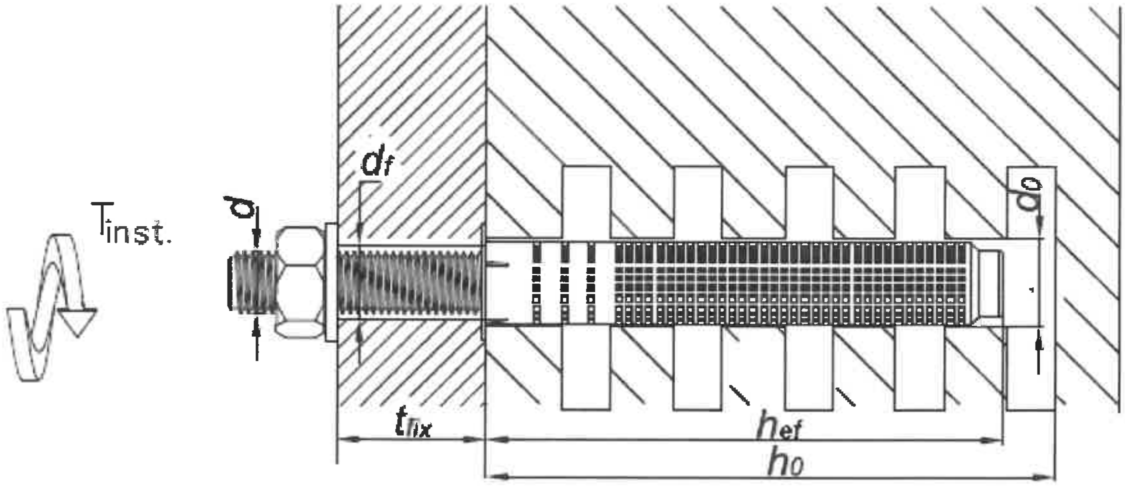
Issued in Warsaw on 14/12/2017 by Instytut Techniki Budowlanej

Anna Panek, MSc
Deputy Director of ITB

Anchor rod without perforated sleeve – installation in solid masonry

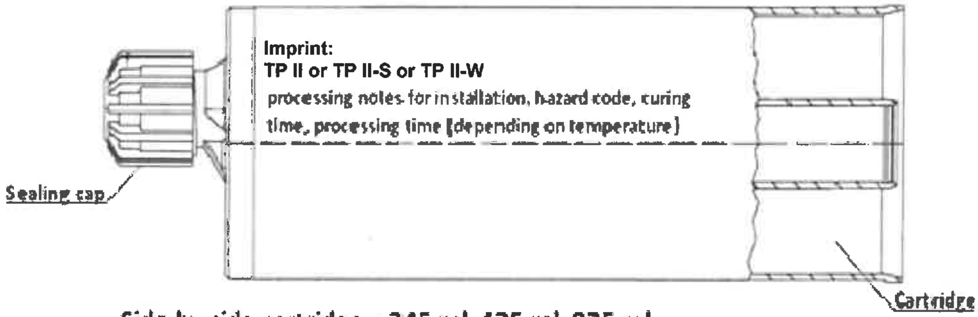


Anchor rod with perforated sleeve – installation in perforated masonry

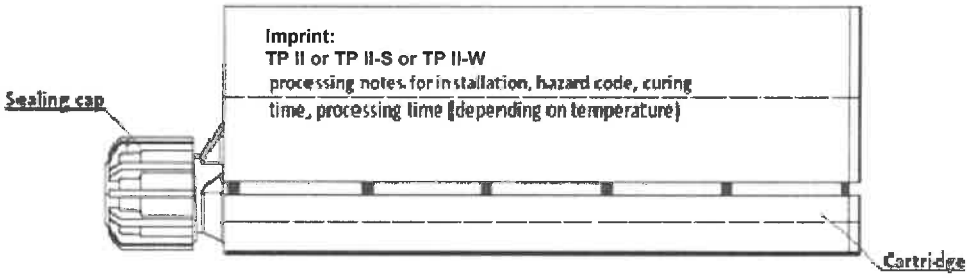


TYTAN PROFESSIONAL Evolution I Universal Injection Anchors	**Annex A1** of European Technical Assessment ETA-17/1055
Product description Installation conditions	

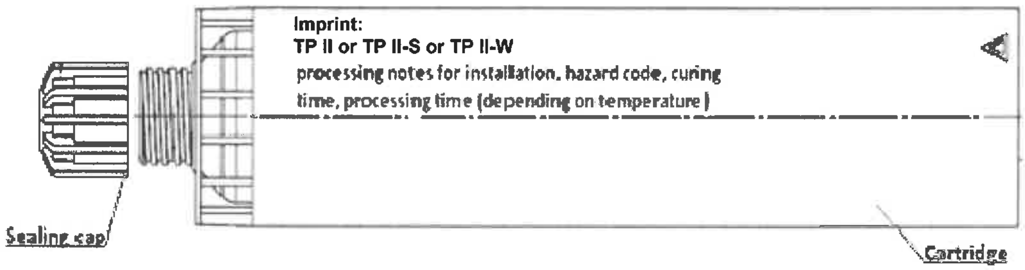
Coaxial cartridge –
150 ml, 280 ml, 300 ml, 310 ml, 330 ml, 380 ml, 400 ml, 410 ml, 420 ml.



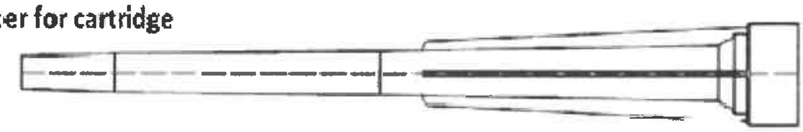
Side by side cartridge – 345 ml, 425 ml, 825 ml.



Cartridge a single component for two part foil capsules –
150 ml, 175 ml, 280ml, 300 ml, 310 ml, 380 ml, 400 ml, 550 ml, 600 ml.

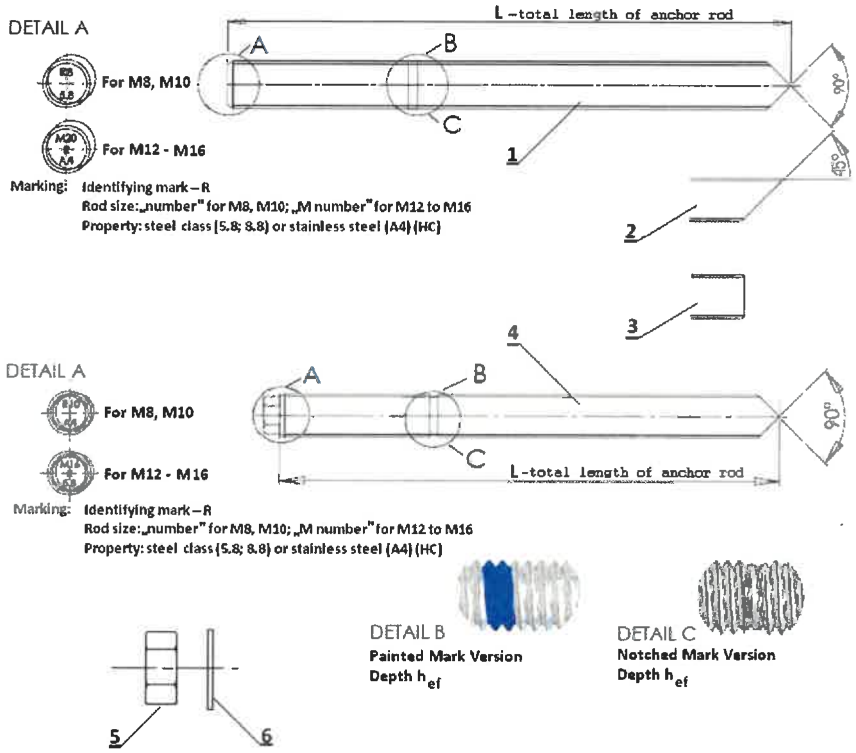


Mixer for cartridge



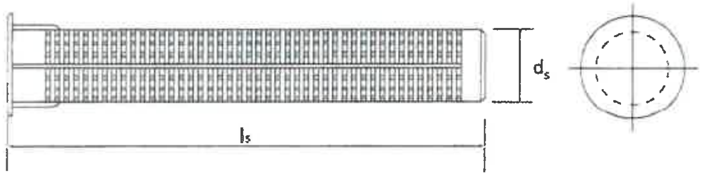
TYTAN PROFESSIONAL Evolution I **Universal Injection Anchors**	**Annex A2** of European Technical Assessment ETA-17/1055
Product description Injection system	

Anchor rods



1. Anchor rod R-STUDS–(88),(A4),(HC)-FL
2. 45° shape with anchor rod
3. The flat end of anchor rod
4. Anchor rod R-STUDS–(88),(A4),(HC) with the hexagonal tip
5. Hexagonal nut
6. Washer

Perforated plastic or metal sleeve



Size of rod			M8	M8	M10	M10	M12	M12	M16
Size of sleeve	d_s x l_s	[mm]	12x50	12x80	16x85	16x130	16x85	16x130	20x85

Table A1: Threaded rods

Part	Designation		
	Steel, zinc plated	**Stainless steel**	**High corrosion resistance stainless steel (HCR)**
Anchor rod	Steel, property class 5.8 to 12.9, acc. to EN ISO 898-1 electroplated ≥ 5 µm acc. to EN ISO 4042 or hot-dip galvanized ≥ 45 µm acc. to EN ISO 10684	Material 1.4401, 1.4404, 1.4571 acc. to EN 10088; property class 70 and 80 (A4-70 and A4-80) acc. to EN ISO 3506	Material 1.4529, 1.4565, 1.4547 acc. to EN 10088; property class 70 acc. to EN ISO 3506
Hexagon nut	Steel, property class 5 to 12, acc. to EN ISO 898-2; electroplated ≥ 5 µm acc. to EN ISO 4042 or hot-dip galvanized ≥ 45 µm acc. to EN ISO 10684	Material 1.4401, 1.4404, 1.4571 acc. to EN 10088; property class 70 and 80 (A4-70 and A4-80) acc. to EN ISO 3506	Material 1.4529, 1.4565, 1.4547 acc. to EN 10088; property class 70 acc. to EN ISO 3506
Washer	Steel, acc. to EN ISO 7089; electroplated ≥ 5 µm acc. to EN ISO 4042 or hot-dip galvanized ≥ 45 µm acc. to EN ISO 10684	Material 1.4401, 1.4404, 1.4571 acc. to EN 10088; corresponding to anchor rod material	Material 1.4529, 1.4565, 1.4547 acc. to EN 10088; corresponding to anchor rod material

Commercial standard threaded rods (in the case of rods made of galvanized steel – standard rods with property class ≤ 8.8 only), with:

- material and mechanical properties according to Table A1,
- confirmation of material and mechanical properties by inspection certificate 3.1 according to EN-10204:2004; the documents shall be stored,
- marking of the threaded rod with the embedment depth.

Note: Commercial standard threaded rods made of galvanized steel with property class above 8.8 are not permitted in some Member States.

Table A2: Injection mortars

Product	**Composition**
TYTAN PROFESSIONAL Evolution I Universal Injection Anchor (TP II) **TYTAN PROFESSIONAL Evolution I Universal Injection Anchor Standard (TP II-S)** **TYTAN PROFESSIONAL Evolution I Universal Injection Anchor Winter (TP II-W)**	Bonding agent: polyester styrene free resin Hardener: dibenzoyl peroxide Additive: quartz sand (filler) Supplied in three colors: standard, grey (G) and stone (ST)

Specification of intended use

Anchorages subject to:

Static and quasi-static loads: sizes from M8 to M16.

Base materials:

- Solid clay bricks (use category b), according to Annex B7.
- Autoclaved aerated concrete blocks AAC (use category d), according to Annex B7.
- Solid silicate bricks (use category b), according to Annex B7.
- Silicate hollow blocks (use category c), according to Annex B7.
- Perforated ceramic blocks (use category c), according to Annexes B7 and B8.
- Lightweight concrete hollow blocks (use category c), according to Annex B8.

Mortar strength class M2,5 at minimum according to EN 998-2.

For smaller brick size or smaller compressive strength in solid masonry or other bricks and blocks in hollow or perforated masonry 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 C9.

Temperature range:

The anchors may be used in the following temperature range:

- -40°C to +40°C (max. short term temperature +40°C and max. long term temperature +24°C).
- -40°C to +80°C (max. short term temperature +80°C and max. long term temperature +50°C).

Use conditions (environmental conditions):

- Elements made of galvanized steel may be used in structures subject to dry internal conditions.
- Elements made of stainless steel may be used in structures subject to dry internal conditions and also in concrete subject to external atmospheric exposure (including industrial and marine environment) or exposure in permanently damp internal conditions if no particular aggressive conditions exist. Such 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).
- Elements made of high corrosion resistant stainless steel may be used in structures subject to dry internal conditions and also in concrete subject to external atmospheric exposure or exposure in permanently damp internal conditions or in other particular aggressive conditions. Such 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 chemical pollution (e.g. in desulphurization plants or road tunnels where de-icing materials are used).

Use categories:

- b, c, d base materials.
- w/w installation and use.

Installation:

- Dry or wet structures.
- Hole drilling by rotary drill mode (AAC, hollow and perforated masonry) and hammer drill mode (solid masonry).

Design:

- Verifiable calculation notes and drawings are prepared taking account the relevant masonry in the region of the anchorage, the loads to be transmitted and their transmission to the supports of the structure. The position of the anchor is indicated on the design drawings.
- The anchorages are designed in accordance with to ETAG 029, Annex C, design method A under the responsibility of an engineer experienced in anchorages and masonry work.

Table B1: Installation parameters of anchor rods in solid masonry and AAC (without perforated sleeves)

Size of rod				M8	M10	M12	M16
Diameter of rod		d	[mm]	8	10	12	16
Drilling diameter		d_0	[mm]	10	12	14	18
Diameter of the hole in the fixture		d_{fix}	[mm]	9	12	14	18
Depth of the drilling hole		h_0	[mm]	85	90	100	110
Embedment depth		h_{ef}	[mm]	80	85	95	105
Torque moment	solid masonry	max. T_{inst}	[Nm]	5	8	10	15
	AAC			3	4	6	10
Minimum spacing and edge distance							
Minimum spacing		s_{min}	[mm]	50	50	50	54
Minimum edge distance		c_{min}	[mm]	50	50	50	54

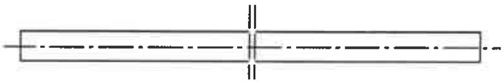
Table B2: Installation parameters of anchor rods with perforated sleeves in hollow or perforated masonry

Size of rod			M8	M8	M10	M10	M12	M12	M16
Size of sleeve	$d_s x l_s$	[mm]	12x50	12x80	16x85	16x130	16x85	16x130	20x85
Diameter of rod	d	[mm]	8	8	10	10	12	12	16
Drilling diameter	d_0	[mm]	12	12	16	16	16	16	20
Diameter of the hole in the fixture	d_{fix}	[mm]	9	9	12	12	14	14	18
Depth of the drilling hole	h_0	[mm]	55	85	90	130	90	130	90
Embedment depth	h_{ef}	[mm]	50	80	85	125	85	125	85
Torque moment	max. T_{inst}	[Nm]	3	3	4	4	6	6	10
Minimum spacing and edge distance									
Minimum spacing	s_{min}	[mm]	100	100	100	100	100	100	120
Minimum edge distance	c_{min}	[mm]	100	100	100	100	100	100	120

Table B3: Processing time and minimum curing time

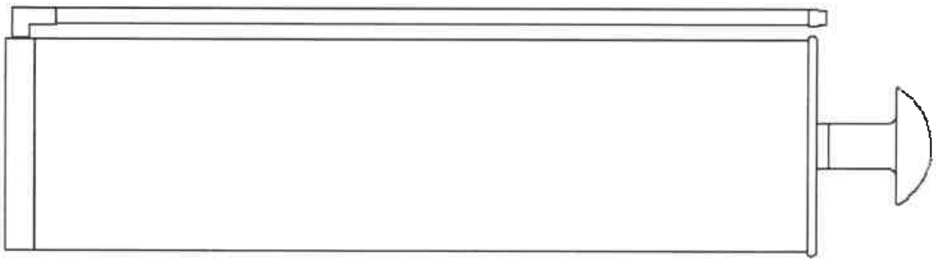
Mortar temperature	Base material temperature	Processing time [min.]			Minimum curing time [min.]		
		TP II	TP II-S	TP II-W	TP II	TP II-S	TP II-W
5°C	-20°C	-	-	45	-	-	1440
5°C	-15°C	-	-	30	-	-	1080
5°C	-10°C	-	-	20	-	-	480
5°C	-5°C	70	180	11	480	1440	300
5°C	0°C	45	120	7	240	1080	120
5°C	5°C	25	60	5	120	720	60
10°C	10°C	15	45	2	90	480	45
15°C	15°C	9	25	1,5	60	360	30
20°C	20°C	5	15	1	45	240	15
25°C	30°C	2	7	-	30	90	-
25°C	35°C	-	6	-	-	60	-
25°C	40°C	-	5	-	-	45	-

Additional mixer extension



*Variable length from 300mm up to 1000mm.

Manual blower pump



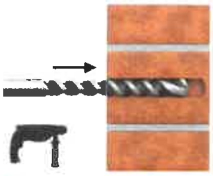
Steel brush

Brush diameter for solid masonry

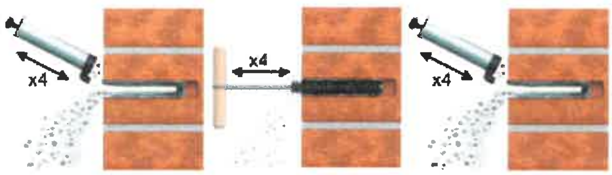
Size of rod			M8	M10	M12	M16
Brush diameter	d_b	[mm]	12	14	16	20

Brush diameter for hollow or perforated masonry

Size of rod			M8	M10	M12	M16
Brush diameter	d_b	[mm]	12	16	16	20

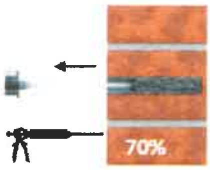


1. Drill the hole to the required diameter and depth (hammer drilling for solid masonry and rotary drilling for AAC).

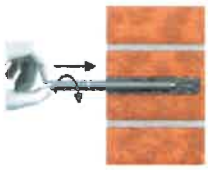


2. Clean the hole with brush and hand pump: at least four blowing operations then four brushing operations followed again by four blowing operations.

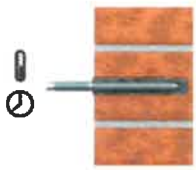
3. Insert cartridge into gun and attach nozzle. Dispense to waste until an even colour is obtained.



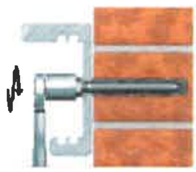
4. Insert the mixing nozzle to the far end the hole and inject the resin, slowly withdrawing the nozzle as the hole is filled to 70% of it's depth.



5. Immediately insert the stud, slowly and with slight twisting motion. Remove any excess resin around the hole before it sets.

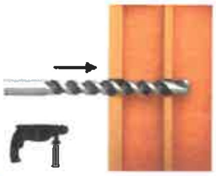


6. Leave the fixing undisturbed until the curing time elapses.

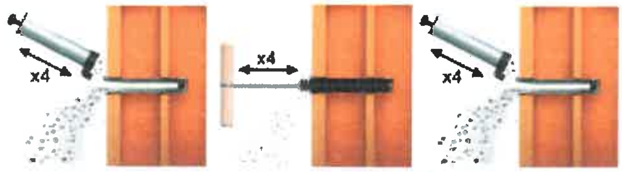


7. Attach the fixture and tighten the nut (max. torque acc. to Table B1).

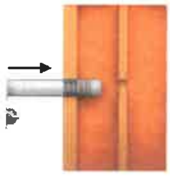
TYTAN PROFESSIONAL Evolution I **Universal Injection Anchors**	**Annex B5** of European Technical Assessment ETA-17/1055
Intended use Installation instruction – solid masonry and AAC	



1. Drill the hole to the required diameter and depth using a rotary machine.

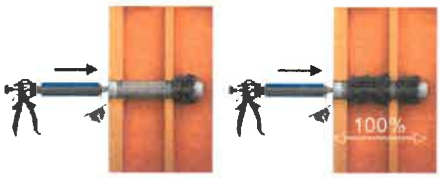


2. Clean the hole with brush and hand pump: at least four blowing operations then two brushing operations followed again by four blowing operations.

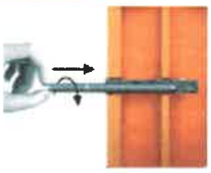


3. Introduce the perforated sleeve of suitable dimension.

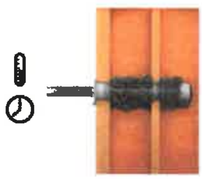
4. Insert cartridge into gun and attach nozzle. Dispense to waste until an even colour is obtained.



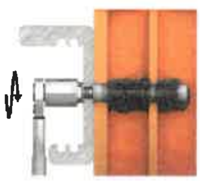
5. Insert the nozzle to the end of the sleeve and inject the resin so long till the sleeve will fill into 100% of depth.



6. Immediately insert the stud, slowly and with slight twisting motion. Remove any excess resin around the hole before it sets.



7. Leave the fixing undisturbed until minimum curing time elapses.



8. Attach the fixture and tighten the nut (max. torque acc. to Table B2).

TYTAN PROFESSIONAL Evolution I
Universal Injection Anchors

Intended use
Installation instruction – hollow and perforated masonry

Annex B6
of European
Technical Assessment
ETA-17/1055

Table B4: Base materials

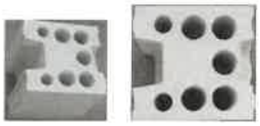
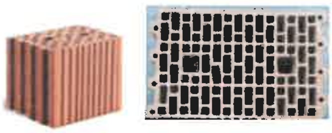
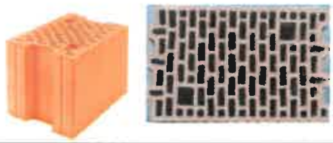
Type and dimensions	Standard
Brick No. 1. Solid clay bricks: 240 x 115 x 71 mm (e.g. Wienerberger Mz 20/2.0) $f_b \geq 20$ N/mm^2; $\rho_m \geq 2{,}0$ kg/dm^3 	EN 771-1
Brick No. 2. Autoclaved aerated concrete blocks AAC 7: 599 x 199 x 240 mm $f_b \geq 6$ N/mm^2; $\rho_m \geq 0{,}65$ kg/dm^3 	EN 771-4
Brick No. 3. Solid silicate bricks: 240 x 115 x 71 mm (e.g. KS NF 20/2.0) $f_b \geq 20$ N/mm^2; $\rho_m \geq 2{,}0$ kg/dm^3 	EN 771-2
Brick No. 4. Silicate hollow blocks: 248 x 240 x 238 mm (e.g. KS Ratio Block 8 DF 12/1.4) $f_b \geq 12$ N/mm^2; $\rho_m \geq 1{,}4$ kg/dm^3 	EN 771-2
Brick No. 5. Perforated ceramic blocks: 373 x 240 x 249 mm (e.g. Poroton Hlz 12/0.9 DF) $f_b \geq 12$ N/mm^2; $\rho_m \geq 0{,}9$ kg/dm^3 	EN 771-1
Brick No. 6. Perforated ceramic blocks: 373 x 238 x 250 mm (e.g. Wienerberger Porotherm 25 P+W); $f_b \geq 15$ N/mm^2; $\rho_m \geq 0{,}8$ kg/dm^3 	EN 771-1
Brick No. 7. Perforated ceramic blocks: 380 x 250 x 238 mm (e.g. Leier Thermopor 38 P+W) $f_b \geq 10$ N/mm^2; $\rho_m \geq 0{,}7$ kg/dm^3 	EN 771-1

Table B5: Base materials

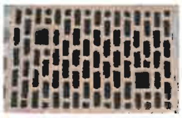
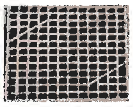
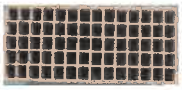
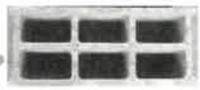
Type and dimensions	Standard
Brick No. 8. Perforated ceramic blocks: 375 x 250 x 238 mm (e.g. Kozłowice MEGA-MAX 250/238 P+W); $f_b \geq 15$ N/mm^2; $\rho_m \geq 0{,}8$ kg/dm^3  	EN 771-1
Brick No. 9. Perforated ceramic blocks: 300 x 375 x 212 mm (e.g. LS Tableau Mono Rect) $f_b \geq 6$ N/mm^2; $\rho_m \geq 0{,}93$ kg/dm^3  	EN 771-1
Brick No. 10. Perforated ceramic blocks: 500 x 200 x 314 mm (e.g. LS Tableau Rect) $f_b \geq 6$ N/mm^2; $\rho_m \geq 0{,}75$ kg/dm^3  	EN 771-1
Brick No. 11. Perforated ceramic blocks: 300 x 300 x 212 mm (e.g. LS Monomur 30) $f_b \geq 6$ N/mm^2; $\rho_m \geq 0{,}865$ kg/dm^3  	EN 771-1
Brick No. 12. Perforated ceramic blocks: 500 x 200 x 314 mm (e.g. SM BGV Thermo) $f_b \geq 6$ N/mm^2; $\rho_m \geq 0{,}659$ kg/dm^3  	EN 771-1
Brick No. 13. Perforated ceramic blocks: 500 x 200 x 314 mm (e.g. SM BGV Thermo Plus) $f_b \geq 6$ N/mm^2; $\rho_m \geq 0{,}755$ kg/dm^3  	EN 771-1
Brick No. 14. Lightweight concrete hollow blocks Hbl: 245 x 245 x 300 mm $f_b \geq 2$ N/mm^2; $\rho_m \geq 0{,}8$ kg/dm^3  	EN 771-3

Table C1: Characteristic tension load and shear load values

Density / compressive strength	Sleeve	Anchor size	Effective anchorage depth	Characteristic resistance	Characteristic resistance
ρ_m / f_b	$\phi d_s x l_s$	M	h_{ef}	N_{Rk} [1]	V_{Rk} [2]
[kg/dm³] / [N/mm²]	[-]	[-]	[mm]	[kN]	[kN]
Brick No. 1					
$\rho_m \geq 2{,}0$ $f_b \geq 20$	without	M8	80	6,0	3,5
		M10	85	7,0	5,0
		M12	95	7,0	7,0
		M16	105	7,0	7,0
Brick No. 2					
$\rho_m \geq 0{,}65$ $f_b \geq 6$	without	M8	80	1,5	1,5
		M10	85	2,0	2,0
		M12	95	2,5	2,5
		M16	105	3,0	2,5
Brick No. 3					
$\rho_m \geq 2{,}0$ $f_b \geq 20$	without	M8	80	5,0	3,5
		M10	85	5,0	5,0
		M12	95	5,0	5,0
		M16	105	5,0	5,0
Brick No. 4					
$\rho_m \geq 1{,}4$ $f_b \geq 12$	ϕ12x50	M8	50	2,5	2,5
	ϕ12x80	M8	80	2,5	2,5
	ϕ15x85	M10	85	2,5	2,5
	ϕ15x125	M10	125	3,5	2,5
	ϕ15x85	M12	85	3,0	2,5
	ϕ15x125	M12	125	3,0	2,5
	ϕ20x85	M16	85	3,0	2,5
Brick No. 5					
$\rho_m \geq 0{,}9$ $f_b \geq 12$	ϕ12x50	M8	50	2,0	2,0
	ϕ12x80	M8	80	2,5	2,5
	ϕ15x85	M10	85	3,0	2,5
	ϕ15x125	M10	125	3,5	2,5
	ϕ15x85	M12	85	3,5	2,5
	ϕ15x125	M12	125	4,0	2,5
	ϕ20x85	M16	85	4,0	2,5
Partial safety factor γ_M = 2,0 for AAC (Brick No. 2) and γ_M = 2,5 for other base materials (in the absence of national regulation)					

[1] For design according to ETAG 029, Annex C: $N_{Rk} = N_{Rk,p} = N_{Rk,b} = N_{R,pb} = N_{Rk,s}$

[2] For design according to ETAG 029, Annex C: $V_{Rk} = V_{Rk,b} = V_{Rk,c} = V_{Rk,s}$

For solid masonry (Brick No. 1, 2 and 3) $V_{Rk,c}$ shall be calculated acc. to ETAG 029, Annex C, equation C.5.7.

Table C2: Characteristic tension load and shear load values

Density / Compressive strength	Sleeve	Anchor size	Effective anchorage depth	Characteristic resistance	Characteristic resistance
ρ_m / f_b	$\phi d_s x l_s$	M	h_{ef}	N_{Rk} [1]	V_{Rk} [2]
[kg/dm³] / [N/mm²]	[-]	[-]	[mm]	[kN]	[kN]
Brick No. 6					
$\rho_m \geq 0{,}8$ $f_b \geq 15$	ϕ12x50	M8	50	1,5	1,5
	ϕ12x80	M8	80	2,0	2,0
	ϕ15x85	M10	85	2,5	2,0
	ϕ15x125	M10	125	2,5	2,5
	ϕ15x85	M12	85	3,5	2,5
	ϕ15x125	M12	125	3,5	2,5
	ϕ20x85	M16	85	2,5	2,5
Brick No. 7					
$\rho_m \geq 0{,}7$ $f_b \geq 10$	ϕ12x50	M8	50	1,5	1,5
	ϕ12x80	M8	80	2,0	2,0
	ϕ15x85	M10	85	2,0	2,0
	ϕ15x125	M10	125	2,5	2,5
	ϕ15x85	M12	85	2,5	2,5
	ϕ15x125	M12	125	3,5	2,5
	ϕ20x85	M16	85	3,0	2,5
Brick No. 8					
$\rho_m \geq 0{,}8$ $f_b \geq 15$	ϕ12x50	M8	50	2,0	2,0
	ϕ12x80	M8	80	2,5	2,5
	ϕ15x85	M10	85	3,5	2,5
	ϕ15x125	M10	125	3,5	2,5
	ϕ15x85	M12	85	4,0	2,5
	ϕ15x125	M12	125	4,0	2,5
	ϕ20x85	M16	85	4,0	2,5
Brick No. 9					
$\rho_m \geq 0{,}93$ $f_b \geq 6$	ϕ12x50	M8	50	0,9	0,9
	ϕ12x80	M8	80	0,9	0,9
	ϕ15x85	M10	85	2,0	1,5
	ϕ15x125	M10	125	2,0	2,0
	ϕ15x85	M12	85	2,0	2,0
	ϕ15x125	M12	125	2,0	2,0
	ϕ20x85	M16	85	1,5	1,2
Partial safety factor $\gamma_M = 2{,}5$ (in the absence of national regulation)					

[1] For design according to ETAG 029, Annex C: $N_{Rk} = N_{Rk,p} = N_{Rk,b} = N_{R,pb} = N_{Rk,s}$

[2] For design according to ETAG 029, Annex C: $V_{Rk} = V_{Rk,b} = V_{Rk,c} = V_{Rk,s}$

Table C3: Characteristic tension load and shear load values

Density / Compressive strength	Sleeve	Anchor size	Effective anchorage depth	Characteristic resistance	Characteristic resistance
ρ_m / f_b	$\phi d_s x l_s$	M	h_{ef}	N_{Rk} [1]	V_{Rk} [2]
[kg/dm³] / [N/mm²]	[-]	[-]	[mm]	[kN]	[kN]
Brick No. 10					
$\rho_m \geq 0,75$ $f_b \geq 6$	ϕ12x50	M8	50	1,2	0,9
	ϕ12x80	M8	80	1,2	1,2
	ϕ15x85	M10	85	1,5	1,5
	ϕ15x125	M10	125	1,5	1,5
	ϕ15x85	M12	85	2,0	1,5
	ϕ15x125	M12	125	2,0	2,0
	ϕ20x85	M16	85	1,5	1,5
Brick No. 11					
$\rho_m \geq 0,865$ $f_b \geq 6$	ϕ12x50	M8	50	0,9	0,9
	ϕ12x80	M8	80	0,9	0,9
	ϕ15x85	M10	85	1,5	1,2
	ϕ15x125	M10	125	1,5	1,5
	ϕ15x85	M12	85	1,5	1,5
	ϕ15x125	M12	125	1,5	1,5
	ϕ20x85	M16	85	1,5	1,5
Brick No. 12					
$\rho_m \geq 0,659$ $f_b \geq 6$	ϕ12x50	M8	50	0,9	0,9
	ϕ12x80	M8	80	0,9	0,9
	ϕ15x85	M10	85	1,5	1,5
	ϕ15x125	M10	125	1,5	1,5
	ϕ15x85	M12	85	1,5	1,5
	ϕ15x125	M12	125	1,5	1,5
	ϕ20x85	M16	85	1,5	1,5
Brick No. 13					
$\rho_m \geq 0,755$ $f_b \geq 6$	ϕ12x50	M8	50	1,2	0,9
	ϕ12x80	M8	80	1,2	1,2
	ϕ15x85	M10	85	1,2	0,9
	ϕ15x125	M10	125	1,2	0,9
	ϕ15x85	M12	85	1,2	1,2
	ϕ15x125	M12	125	1,5	1,5
	ϕ20x85	M16	85	1,2	1,2
Partial safety factor γ_M = 2,5 (in the absence of national regulation)					

[1] For design according to ETAG 029, Annex C: $N_{Rk} = N_{Rk,p} = N_{Rk,b} = N_{R,pb} = N_{Rk,s}$
[2] For design according to ETAG 029, Annex C: $V_{Rk} = V_{Rk,b} = V_{Rk,c} = V_{Rk,s}$

Table C4: Characteristic tension load and shear load values

Density / Compressive strength	Sleeve	Anchor size	Effective anchorage depth	Characteristic resistance	Characteristic resistance
ρ_m / f_b	$\phi d_s x l_s$	M	h_{ef}	N_{Rk} [1]	V_{Rk} [2]
[kg/dm³] / [N/mm²]	[-]	[-]	[mm]	[kN]	[kN]
Brick No. 14					
$\rho_m \geq 0,8$ $f_b \geq 2$	ϕ12x50	M8	50	1,2	1,2
	ϕ12x80	M8	80	1,5	1,5
	ϕ15x85	M10	85	2,5	2,5
	ϕ15x125	M10	125	2,5	2,0
	ϕ15x85	M12	85	2,5	2,5
	ϕ15x125	M12	125	2,5	2,5
	ϕ20x85	M16	85	2,5	2,5
Partial safety factor γ_M = 2,5 (in the absence of national regulation)					

[1] For design according to ETAG 029, Annex C: $N_{Rk} = N_{Rk,p} = N_{Rk,b} = N_{R,pb} = N_{Rk,s}$
[2] For design according to ETAG 029, Annex C: $V_{Rk} = V_{Rk,b} = V_{Rk,c} = V_{Rk,s}$

Table C5: Characteristic bending moments

Size of rod				M8	M10	M12	M16
Characteristic bending moment	$M_{Rk,s}$	Nm	5.8	19	37	65	166
			6.8	22	45	79	200
			A4-70	26	52	92	232
Partial safety factor	γ_{Ms}	-	5.8	1,25			
			6.8	1,25			
			A4-70	1,56			

Table C6: Displacement under tension load

Brick No. 1					
Size of rod		M8	M10	M12	M16
δ_{N0}	[mm]	0,11	0,12	0,15	0,16
$\delta_{N\infty}$	[mm]	0,36	0,36	0,36	0,36
Brick No. 2					
Size of rod		M8	M10	M12	M16
δ_{N0}	[mm]	0,05	0,07	0,10	0,11
$\delta_{N\infty}$	[mm]	0,19	0,19	0,20	0,22
Brick No. 3					
Size of rod		M8	M10	M12	M16
δ_{N0}	[mm]	0,13	0,15	0,15	0,18
$\delta_{N\infty}$	[mm]	0,36	0,36	0,36	0,36
Brick No. 4					
Size of rod		M8	M10	M12	M16
δ_{N0}	[mm]	0,10	0,13	0,15	0,18
$\delta_{N\infty}$	[mm]	0,36	0,36	0,36	0,36
Brick No. 5					
Size of rod		M8	M10	M12	M16
δ_{N0}	[mm]	0,14	0,13	0,24	0,18
$\delta_{N\infty}$	[mm]	0,36	0,36	0,48	0,36
Brick No. 6					
Size of rod		M8	M10	M12	M16
δ_{N0}	[mm]	0,09	0,27	0,14	0,16
$\delta_{N\infty}$	[mm]	0,36	0,54	0,36	0,36
Brick No. 7					
Size of rod		M8	M10	M12	M16
δ_{N0}	[mm]	0,05	0,16	0,30	0,28
$\delta_{N\infty}$	[mm]	0,36	0,36	0,60	0,56

Equation $N = N_{Rk} / \gamma_F \times \gamma_M$, with $\gamma_F = 1,4$

Table C7: Displacement under tension load

Brick No. 8					
Size of rod		M8	M10	M12	M16
δ_{N0}	[mm]	0,08	0,10	0,10	0,27
$\delta_{N\infty}$	[mm]	0,36	0,36	0,36	0,54
Brick No. 9					
Size of rod		M8	M10	M12	M16
δ_{N0}	[mm]	0,06	0,04	0,07	0,10
$\delta_{N\infty}$	[mm]	0,36	0,36	0,36	0,36
Brick No. 10					
Size of rod		M8	M10	M12	M16
δ_{N0}	[mm]	0,04	0,05	0,08	0,12
$\delta_{N\infty}$	[mm]	0,36	0,36	0,36	0,36
Brick No. 11					
Size of rod		M8	M10	M12	M16
δ_{N0}	[mm]	0,04	0,05	0,08	0,12
$\delta_{N\infty}$	[mm]	0,36	0,36	0,36	0,36
Brick No. 12					
Size of rod		M8	M10	M12	M16
δ_{N0}	[mm]	0,06	0,08	0,08	0,15
$\delta_{N\infty}$	[mm]	0,36	0,36	0,36	0,36
Brick No. 13					
Size of rod		M8	M10	M12	M16
δ_{N0}	[mm]	0,04	0,04	0,10	0,07
$\delta_{N\infty}$	[mm]	0,36	0,36	0,36	0,36
Brick No. 14					
Size of rod		M8	M10	M12	M16
δ_{N0}	[mm]	0,22	0,25	0,30	0,20
$\delta_{N\infty}$	[mm]	0,44	0,50	0,60	0,40

Equation $N = N_{Rk} / \gamma_F \times \gamma_M$, with $\gamma_F = 1{,}4$

Table C8: Displacement under shear load

Brick No. 1					
Size of rod		M8	M10	M12	M16
δ_{V0}	[mm]	0,29	0,33	0,34	0,42
$\delta_{V\infty}$	[mm]	0,44	0,50	0,51	0,63
Brick No. 2					
Size of rod		M8	M10	M12	M16
δ_{V0}	[mm]	0,15	0,16	0,22	0,23
$\delta_{V\infty}$	[mm]	0,23	0,24	0,33	0,35
Brick No. 3					
Size of rod		M8	M10	M12	M16
δ_{V0}	[mm]	0,21	0,22	0,25	0,25
$\delta_{V\infty}$	[mm]	0,32	0,33	0,38	0,38
Brick No. 4					
Size of rod		M8	M10	M12	M16
δ_{V0}	[mm]	0,10	0,13	0,16	0,20
$\delta_{V\infty}$	[mm]	0,15	0,20	0,24	0,30
Brick No. 5					
Size of rod		M8	M10	M12	M16
δ_{V0}	[mm]	0,18	0,22	0,25	0,25
$\delta_{V\infty}$	[mm]	0,27	0,33	0,38	0,38
Brick No. 6					
Size of rod		M8	M10	M12	M16
δ_{V0}	[mm]	0,18	0,21	0,23	0,19
$\delta_{V\infty}$	[mm]	0,27	0,32	0,35	0,29
Brick No. 7					
Size of rod		M8	M10	M12	M16
δ_{V0}	[mm]	0,24	0,2	0,34	0,26
$\delta_{V\infty}$	[mm]	0,36	0,30	0,51	0,39

Equation $V = V_{Rk} / \gamma_F \times \gamma_M$, with $\gamma_F = 1,4$

Table C9: Displacement under shear load

Brick No. 8					
Size of rod		M8	M10	M12	M16
δ_{V0}	[mm]	0,11	0,13	0,36	0,27
$\delta_{V\infty}$	[mm]	0,17	0,20	0,54	0,41
Brick No. 9					
Size of rod		M8	M10	M12	M16
δ_{V0}	[mm]	0,12	0,15	0,22	0,21
$\delta_{V\infty}$	[mm]	0,18	0,23	0,33	0,32
Brick No. 10					
Size of rod		M8	M10	M12	M16
δ_{V0}	[mm]	0,11	0,14	0,15	0,25
$\delta_{V\infty}$	[mm]	0,17	0,21	0,23	0,38
Brick No. 11					
Size of rod		M8	M10	M12	M16
δ_{V0}	[mm]	0,14	0,15	0,25	0,20
$\delta_{V\infty}$	[mm]	0,21	0,23	0,38	0,30
Brick No. 12					
Size of rod		M8	M10	M12	M16
δ_{V0}	[mm]	0,09	0,11	0,24	0,26
$\delta_{V\infty}$	[mm]	0,14	0,17	0,36	0,39
Brick No. 13					
Size of rod		M8	M10	M12	M16
δ_{V0}	[mm]	0,1	0,14	0,17	0,21
$\delta_{V\infty}$	[mm]	0,15	0,21	0,26	0,32
Brick No. 14					
Size of rod		M8	M10	M12	M16
δ_{V0}	[mm]	0,24	0,35	0,32	0,34
$\delta_{V\infty}$	[mm]	0,36	0,53	0,48	0,51

Equation $V = V_{Rk} / \gamma_F \times \gamma_M$, with $\gamma_F = 1,4$

Table C10: β-factor for job site tests according to ETAG 029, Annex B

Base material	Size of rod	β-factor
Brick No. 1	M8 to M16	0,71
Brick No. 2	M8 to M16	0,59
Brick No. 3 to 14	M8 to M16	0,71

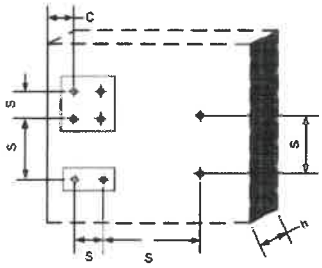


Table C11: Brick No. 1, 2 and 3 - edge distance and spacing for tension load

d_{nom}	$s_{cr,N}$	$c_{cr,N}$	$s_{cr,min}$	$c_{cr,min}$
[mm]	[mm]	[mm]	[mm]	[mm]
8	20 x d_{nom}	10 x d_{nom}	50	50
10	20 x d_{nom}	10 x d_{nom}	50	50
12	20 x d_{nom}	10 x d_{nom}	50	50
16	20 x d_{nom}	10 x d_{nom}	54	54

Table C12: Brick No. 4 to 14 - edge distance and spacing for tension load

d_{nom} + $\phi d_s x L_s$	$s_{cr,N}$	$c_{cr,N}$	$s_{cr,min}$	$c_{cr,min}$
[mm]	[mm]	[mm]	[mm]	[mm]
8 + ϕ12x50	$l_{unit,max}$	0,5 x $l_{unit,max}$	100	100
8 + ϕ12x80	$l_{unit,max}$	0,5 x $l_{unit,max}$	100	100
10 + ϕ15x85	$l_{unit,max}$	0,5 x $l_{unit,max}$	100	100
10 + ϕ15x125	$l_{unit,max}$	0,5 x $l_{unit,max}$	100	100
12 + ϕ15x85	$l_{unit,max}$	0,5 x $l_{unit,max}$	100	100
12 + ϕ15x125	$l_{unit,max}$	0,5 x $l_{unit,max}$	100	100
16 + ϕ20x85	$l_{unit,max}$	0,5 x $l_{unit,max}$	120	120

Table C13: Brick No. 4 to 14 - edge distance and spacing for shear load

d_{nom} + $\phi d_s x L_s$	$s_{cr,cv}$	$c_{cr,cv}$
[mm]	[mm]	[mm]
8 + ϕ12x50	$l_{unit,max}$	$l_{unit,max}$
8 + ϕ12x80	$l_{unit,max}$	$l_{unit,max}$
10 + ϕ15x85	$l_{unit,max}$	$l_{unit,max}$
10 + ϕ15x125	$l_{unit,max}$	$l_{unit,max}$
12 + ϕ15x85	$l_{unit,max}$	$l_{unit,max}$
12 + ϕ15x125	$l_{unit,max}$	$l_{unit,max}$
16 + ϕ20x85	$l_{unit,max}$	$l_{unit,max}$

$l_{unit,max}$ – max. length of masonry unit