PARACHIM VINYLESTER

CHARACTERISTICS

- Two component anchoring mortar for anchoring into solid and hollow materials
- Superior performance for structural applications
- Styrene free, can be used in confined spaces
- Ready to use, pre-cut packaging
- Fast loading time
- With colour indicator for working time (blue turns grey)
- Anchoring may be placed close to the edges (see table installation parameters)
- Can be applied with a standard cartridge gun
- Chemical resistant to many acids, bases, solvents, hydrocarbons, sea water... (Contact the technical service)

APPLICATIONS

- For all types of stress-free anchorages in hollow materials (hollow masonry and voided stone) and in solid materials (concrete, solid masonry, rock, hard natural stone). Anchoring is suitable for non-cracked concrete, reinforced or non-reinforced, from strength class C20/25 up to a maximum of class C50/60. For high load structural anchoring applications in hollow and solid materials: for fixing roller shutters, staircase hand rails, sun protection, canopies, boilers, racking, bicycle racks, masonry supports, signs, safety barriers, balcony fences, satellite dishes...
- Suitable for overhead installations (without additional accessories)
- Retrofitting reinforcing bars in reinforced concrete: installing a balcony, expanding a building, replacing or adding a floor slab, reinforcing a wall...
- For retrofitting reinforcement bars: suitable for reinforced or non-reinforced concrete from strength class C12/15 up to a maximum of C50/60.
- Suitable for dry, wet and flooded (*) holes without loss of performance

TECHNICAL CHARACTERISTICS	
Type of product	Vinylester
Mixing ratio	10:1
Curing system	2-component chemical reaction
Packaging	Flexible pocket with 2 compartments for component A and component B contained in a single-piston cartridge
Working time	See table
Loading time	See table
Minimum resin cartridge temperature	+5°C
Temperature of base material	-5°C - +40°C
Minimum service temperature	-40°C
Maximum service temperature	Long term (>12h): +50°C Short term (<12h): +80°C
Dimension of threaded rod in uncracked concrete	M8 - M10 - M12 - M16 - M20 - M24
Dimension of threaded rod in masonry	M8 - M10 - M12
Dimension of retrofitted reinforcement bars	ø8 - ø10 - ø12 - ø14 - ø16 - ø20
Shelf life, in the original packing in upside position, out of direct sunlight and in dry conditions between +5°C - +25°C	15 months

PACKING AND COLOUR
12 cartridges of 300 ml/box - 95 boxes/pallet (1140 cartridges)
With curing colour proof from blue to grey

SAFETY Safety data sheet available on request.

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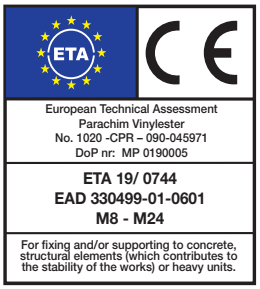
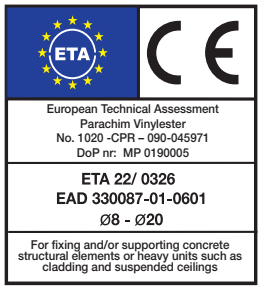
TECHNICAL APPROVALS

- ETA 19/ 0744 according to EAD 330499-01-0601 M8 - M24 for fixing and/or supporting to non-cracked concrete, structural elements (which contributes to the stability of the works) or heavy units.
- ETA 19/ 0743 according to EAD 330076-00-0604 M8 - M12 for fixing and/or supporting to masonry, structural elements (which contributes to the stability of the works) or heavy units.
- ETA 22/0326 according to EAD 330087-01-0601ø8 - ø20 for post-installed reinforcement connections in existing structures of normal weight concrete.
- A+





* Information sur le niveau d'émission de substances volatiles dans l'air intérieur, présentant un risque de toxicité par inhalation, sur une échelle de classe allant de A+ (très faibles émissions) à C (fortes émissions).

POINTS OF ATTENTION

- Refer to the ETA documents for detailed guidelines.
- (*) For post-installed reinforcing bars, the holes must not be flooded.
- Due to the nature of the product, migration of the monomer in the resin may cause staining in certain materials (f. ex. natural stone). Preliminary tests are necessary.
- Not intended for anchoring into porous or reconstituted stone.
- The chemical anchor is not intended for use as a cosmetic or decorative product.
- Not intended for anchoring into holes flooded with seawater.

METHOD OF USE

I. STRUCTURAL ANCHORING APPLICATIONS

I.1 METHOD OF USE

I.1.1 Necessary accessories

I.1.2 Preparation

I.1.3 Injecting chemical anchor

I.1.4 Inserting threaded rod

I.1.5 Working and loading times

I.2 USE IN NON-CRACKED CONCRETE (acc. ETA 19/ 0744)

I.2.1 Installation parameters

I.2.2 Theoretical consumption

I.2.3 Characteristic bond resistance for combined pullout and concrete cone failure

I.2.4 Tension load calculations for combined pullout and concrete cone failure

I.3 USE IN MASONRY (acc. ETA 19/ 0743)

I.3.1 Installation parameters

I.3.2 Theoretical consumption

I.3.3 Edge distances and spacing

I.3.4 Characteristic resistance under tension (NRk) and shear loading (VRk)

I.3.5 Design resistance under tension (NRd) and shear loading (VRd)

I.3.6 Types and dimensions of blocks and bricks

II. POST-INSTALLATION OF REBARS (acc. ETA 22/ 0326)

II.1 METHOD OF USE

II.1.1 Necessary accessories

II.1.2 Preparation

II.1.3 Injecting chemical anchor

II.1.4 Inserting rebar

II.1.5 Working and loading times

II.2 USED IN ARMED CONCRETE

II.2.1 General design for the construction of embedded reinforcement bars

II.2.2 Installation parameters

II.2.3 Theoretical consumption

II.2.4 Design characteristic bond strength of reinforcement bars for a service life of 100 years

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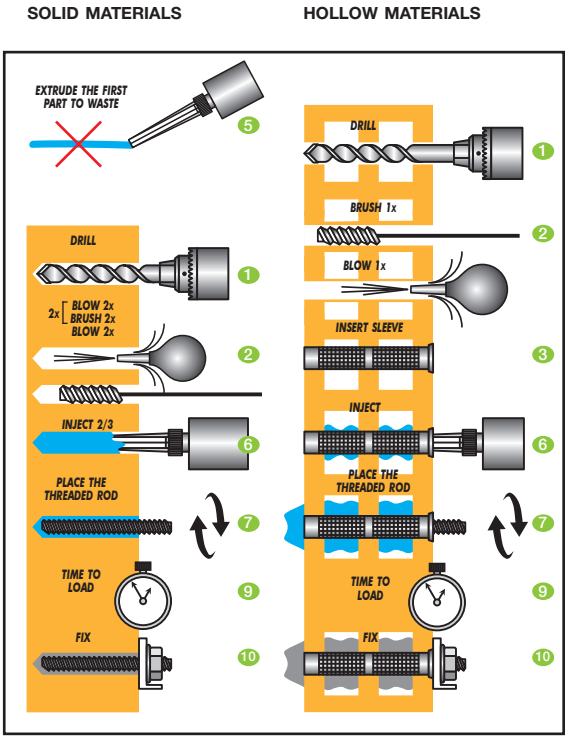
I.1 METHOD OF USE

I.1.1 Necessary accessories

- Standard applicator gun (manual, pneumatic or electric)
- Mixing nozzle (2 pieces included with cartridge)
- Cleansing blowing pump
- Cleansing brush
- Sieve sleeve (in case of hollow materials)

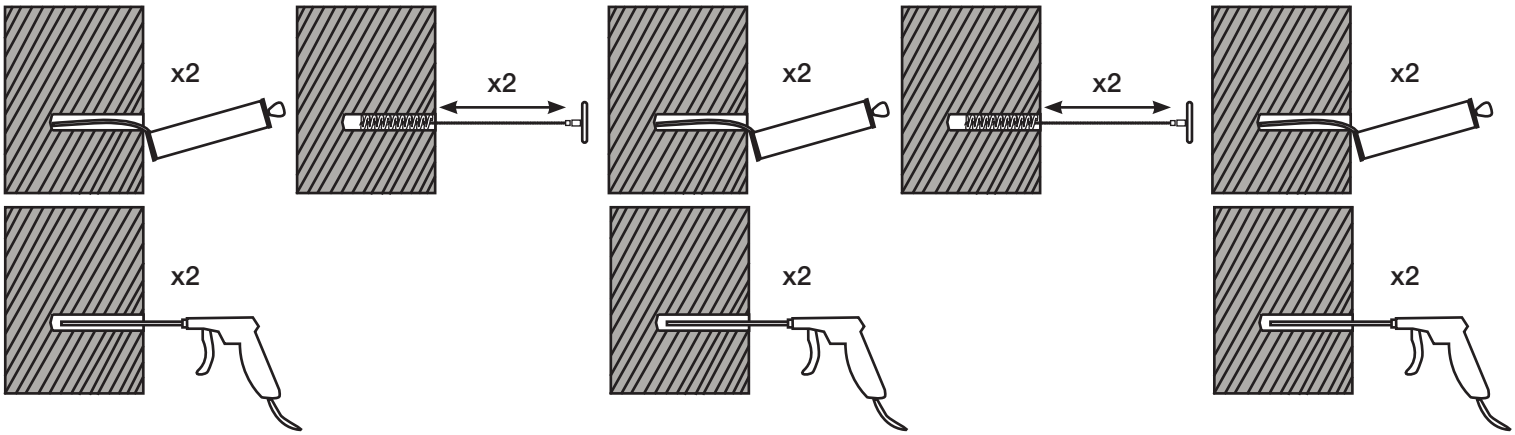


I.1.2 Preparation

1. **Drill the hole with a hammer drill** to the correct diameter and depth.

2. Thoroughly **clean the hole**. For cleaning, the borehole must be free of water. For holes with a depth of 400 mm or less, manual cleaning can be done with a blow pump. Cleaning with compressed air can be done for all diameters of the drill holes. Use a brush with the same diameter as the drill hole and use clean compressed air.

   - For hollow materials: brush once, then blow once.
   - For solid materials: blow twice, then brush twice with a cleaning brush in a back-and-forth motion, blow twice, then brush twice again, and blow twice more.



3. In case of hollow or perforated brick masonry: **insert the correct sieve sleeve**.

4. Once the hole is prepared, open the cartridge and screw **mixer nozzle** onto the mouth of the cartridge. Insert the cartridge into the sealant gun. Extrude the first part of the cartridge to waste until an **even colour** is achieved, without streaking in the extruded product.

I.1.3 Injecting chemical anchor

5. **Insert the mixer nozzle** to the bottom of the hole or the sleeve. Begin to extrude the product and slowly withdraw the mixer nozzle from the hole or the plug ensuring that there are no air voids as the mixer nozzle is withdrawn. For solid materials: fill the hole to approximately ½ to ¾ full and withdraw the nozzle completely. For hollow materials: completely fill the sleeve with resin.

I.1.4 Inserting threaded rod

6. Immediately **insert the clean threaded rod** (free from oil or other release agents) to the bottom of the hole using a back and forth twisting motion ensuring all the threads are thoroughly coated. Adjust to the correct position within the stated working time (see table).

7. Any **excess product** will be expelled from the hole evenly around the steel element showing that the hole is full. This excess product should be removed from around the mouth of the hole before it sets.

8. Leave the anchor to cure. **Do not disturb the anchor until the appropriate loading time has elapsed** (depending on the substrate conditions and ambient temperature).

9. Load with force after curing of the resin. Attach the fixture and tighten the nut to the recommended torque. Do not overtighten.

10. Leave the static mixer nozzle on the cartridge and change with new one just before the next application.

I.1.5 Working and loading times

Temperature of resin cartridge and base material	Working time (Before blue turns to grey)	Loading time (Minimum time required until load can be applied)
-5°C » +0°C*	28 min.**	360 min.**
+0°C » +5°C*	18 min.	255 min.
+5°C » +10°C	10 min.	145 min.
+10°C » +20°C	6 min.	85 min.
+20°C » +25°C	5 min.	50 min.
+25°C » +30°C	4 min.	40 min.
+30°C » +35°C	2 min.**	35 min.**
+35°C » +40°C	1 min.**	25 min.**

T work is typical gel time at highest temperature.
T load is set at the lowest temperature.
*Cartridge temperature may not be lower than +5°C.
**Not part of ETA.

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I.2 USE IN NON-CRACKED CONCRETE

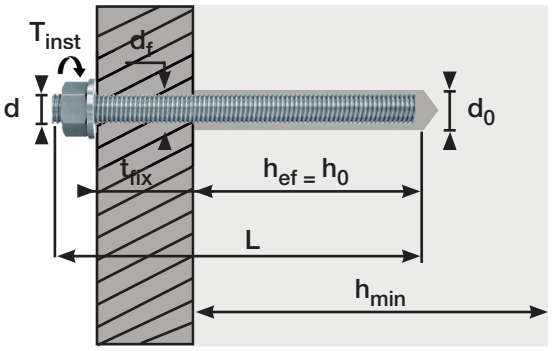
ETA 19/ 0744 according to EAD 330499-01-0601 M8 - M24 for fixing and/or supporting to non-cracked concrete, structural elements (which contributes to the stability of the works) or heavy units.

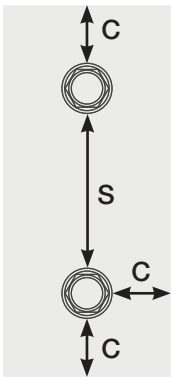
I.2.1 Installation parameters

Threaded rod		M8	M10	M12	M16	M20	M24
Size of threaded rod	**d (mm)**	8	10	12	16	20	24
Nominal drill hole diameter	**d_o (mm)**	10	12	14	18	22	26
Diameter of cleaning brush	**d_b (mm)**	14	14	20	20	29	29
Torque moment	**T_{inst} (Nm)**	10	20	40	80	150	200
Depth of drill hole for h_{ef} min/h_{ef} max	**h_{ef} (mm)**	64/96	80/120	96/144	128/192	160/240	192/288
Minimum edge distance	**c_{min} (mm)**	35/50	40/60	50/70	65/95	80/120	96/145
Minimum spacing	**s_{min} (mm)**	35/50	40/60	50/70	65/95	80/120	96/145
Minimum thickness of base material	**h_{min} (mm)**	h_{ef} + 30 mm ≥ 100 mm			h_{ef} + 2 d_o		

I.2.2 Theoretical consumption (Consumption based on 60% filling rate of drill hole.)

	Drill hole diameter d_o (mm)	Embedment depth h_{ef} min/standard/max (mm)	Number of applications per cartridge (# of drill holes)
M8	10	64	100
		80	**80**
		96	66
M10	12	80	55
		90	**49**
		120	37
M12	14	96	34
		110	**30**
		144	23
M16	18	128	15
		128	**15**
		192	10
M20	22	160	8
		170	**8**
		240	6
M24	26	192	5
		210	**4**
		288	3





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I.2.3 Characteristic bond resistance for combined pullout and concrete cone failure in dry/wet C20/25 uncracked concrete (temperature range: -40°C to +80°C)

		M8	M10	M12	M16	M20	M24
Characteristic bond resistance in dry/wet concrete	$T_{Rk\ uncr}$ (N/mm²)	10	8.0	9.0	9.5	8.5	8.5
Partial safety factor (-)	γ_{Mp}	1.8	1.8	1.8	1.8	1.8	1.8
Factor for concrete	Ψ_c C30/37	1.12					
Factor for concrete	Ψ_c C35/45	1.19					
Factor for concrete	Ψ_c C50/60	1.30					

I.2.4 Tension load calculations for combined pullout and concrete cone failure at various embedment depths using threaded rods in dry/wet C20/25 uncracked concrete (temperature range: -40°C to +80°C)

Property	Symbol	Unit	M8	M10	M12	M16	M20	M24
Effective embedment depth = 8d	h_{ef}	mm	64	80	96	128	160	192
Characteristic load	$N_{Rk,p}$	kN	16.08	20.11	32.57	61.12	85.45	123.05
Partial safety factor	γ_{Mp}	-	1.80	1.80	1.80	1.80	1.80	1.80
Design load	N_{Rd}	**kN**	**8.93**	**11.17**	**18.09**	**33.95**	**47.47**	**68.36**
Effective embedment depth = STD	h_{ef}	mm	80	90	110	128	170	210
Characterstic load	$N_{Rk,p}$	kN	20.11	22.62	37.32	61.12	90.79	134.59
Partial safety factor	γ_{Mp}	-	1.80	1.80	1.80	1.80	1.80	1.80
Design load	N_{Rd}	**kN**	**11.17**	**12.56**	**20.73**	**33.95**	**50.43**	**74.77**
Effective embedment depth = 10d	h_{ef}	mm	80	100	120	160	200	240
Characterstic load	$N_{Rk,p}$	kN	20.11	25.13	40.72	76.40	106.81	153.81
Partial safety factor	γ_{Mp}	-	1.80	1.80	1.80	1.80	1.80	1.80
Design load	N_{Rd}	**kN**	**11.17**	**13.96**	**22.62**	**42.44**	**59.33**	**85.45**
Effective embedment depth = 12d	h_{ef}	mm	96	120	144	192	240	288
Characterstic load	$N_{Rk,p}$	kN	24.13	30.16	48.86	91.68	128.18	184.57
Partial safety factor	γ_{Mp}	-	1.80	1.80	1.80	1.80	1.80	1.80
Design load	N_{Rd}	**kN**	**13.40**	**16.75**	**27.14**	**50.93**	**71.21**	**102.53**

Remarks regarding tension load calculations table

1. Characteristic loads are valid for **combined concrete cone and pullout failure** as defined by TR029 only. All other failure modes, including steel failure, detailed in TR029 as welll as includling combined effects of tension and shear, must be considered in accordance with TR029.
2. Characteristic loads are valid for single anchors without close edge, anchor spacing or eccentric loading considerations.
3. Tabulated values are valid for temperature range -40°C to +80°C (Max LLT = +50°C; Max STT = +80°C).
4. Tabulated values are only valid for the installation conditions stated. Other conditions, such as different temperature ranges, may affect the performance of the product.
5. Long term temperatures are those that remain roughly constant over prolonged periods. Short term temperatures occur over brief intervals, eg: diurnal cycling.
6. The compressive strength of the concrete ($f_{ck,cube}$) is assumed to be 25 N/mm² for C20/25 concrete.
7. Tabulated values assume that the geometry of the anchor(s) and concrete member is sufficient to avoid splitting failure.

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ETA 19/ 0743 according to EAD 330076-00-0604 M8 - M12 for fixing and/or supporting to masonry, structural elements (which contributes to the stability of the works) or heavy units.

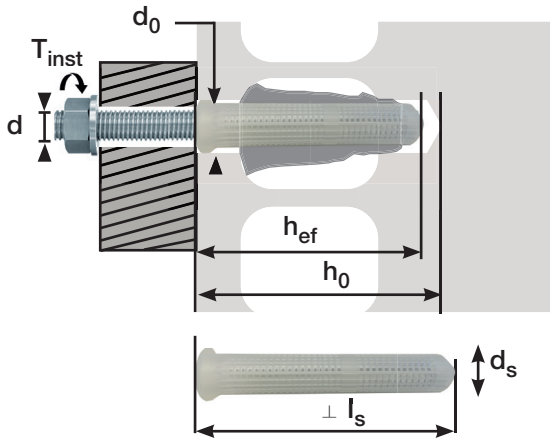
I.3.1 Installation parameters

		Hollow masonry		
Threaded rod		**M8**	**M10**	**M12**
Size of threaded rod	**d (mm)**	8	10	12
Sieve sleeve length	**l_s (mm)**	85	85	85
Sieve sleeve diameter	**d_s (mm)**	16	16	20
Nominal drill hole diameter	**d_o (mm)**	16	16	20
Diameter of cleaning brush	**d_b (mm)**	$20^{\pm 1}$	$20^{\pm 1}$	$22^{\pm 1}$
Depth of drill hole	**h_o (mm)**	90		
Effective anchorage depth	**h_{ef} (mm)**	85		
Diameter of clearance hole in the fixture	**$d_f \leq$ (mm)**	9	12	14
Torque moment	**T_{inst} (Nm)**	2		

For solid masonry: see installation parameters for use in non-cracked concrete.

I.3.2 Theoretical consumption

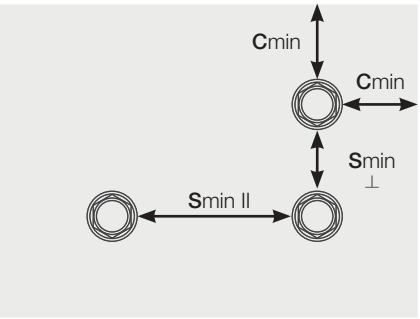
		Drill hole diameter d_o (mm)	Embedment depth h_{ef} (mm)	Number of applications per cartridge (# of drill holes)
Hollow masonry	M8/M10	16	85	15
	M12	20	85	9



I.3.3 Edge distances and spacing

Cmin = Minimum allowable edge distance
Smin II = Minimum allowable spacing parallel to the horizontal joint
Smin ⊥ = Minimum allowable spacing perpendicular to the horizontal joint

	M8			M10			M12		
Base material	Cmin	Smin II	Smin ⊥	Cmin	Smin II	Smin ⊥	Cmin	Smin II	Smin ⊥
	mm	mm	mm	mm	mm	mm	mm	mm	mm
Brick no. 1	100	235	115	100	235	115	100	235	115
Brick no. 2	128	255	255	128	255	255	128	255	255
Brick no. 3	128	255	255	128	255	255	128	255	255
Brick no. 4	100	250	240	100	250	240	100	250	240
Brick no. 5	100	370	238	100	370	238	100	370	238
Brick no. 6	100	245	110	100	245	110	100	245	110
Brick no. 7	100	373	238	100	373	238	100	373	238



I.3.4 Characteristic resistance under tension (N_{Rk}) and shear loading (V_{Rk})

Base material	M8	M10	M12
	$N_{Rk} = V_{Rk}$ [kN]		
Brick no. 1	2.0	2.0	2.0
Brick no. 2	2.0	1.5	2.5
Brick no. 3	1.5	1.5	2.5
Brick no. 4	1.2	1.2	1.2
Brick no. 5	1.2	0.9	0.9
Brick no. 6	0.75	0.75	1.2
Brick no. 7	0.75	0.5	0.5

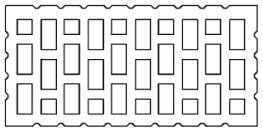
I.3.5 Design resistance under tension (N_{Rd}) and shear loading (V_{Rd})

Partial safety factor for masonry $\gamma_{Mm} = 2.5$ (according TR054)

Base material	M8	M10	M12
	$N_{Rd} = V_{Rd}$ [kN]		
Brick no. 1	0.8	0.8	0.8
Brick no. 2	0.8	1	1
Brick no. 3	1	1	1
Brick no. 4	0.48	0.48	0.48
Brick no. 5	0.48	0.36	0.36
Brick no. 6	0.3	0.3	0.48
Brick no. 7	0.3	0.2	0.2

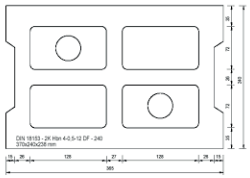
I.3.6 Types and dimensions of blocks and bricks

Brick no.1



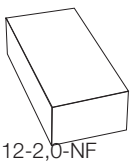
Hollow clay brick Hlz 12-1,0-2DF
according to EN771-1
Length/width/height 235 mm/112 mm/115 mm
$f_b \geq 12$ N/mm² / $\rho \geq 1{,}0$ kg/dm³

Brick no. 2



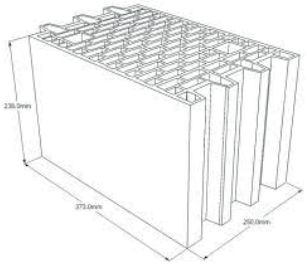
Concrete masonry unit Hbn 4-12DF
according to EN771-3
Length/width/height 370 mm/240 mm/238 mm
$f_b \geq 4$ N/mm² / $\rho \geq 1{,}2$ kg/dm³

Brick no. 3



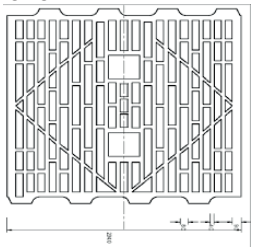
Solid clay brick Mz 12-2,0-NF
according to EN771-1
Length/width/height 240 mm/116 mm/71 mm
$f_b \geq 12$ N/mm² / $\rho \geq 2{,}0$ kg/dm³

Brick no. 4



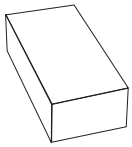
Hollow clay brick Porotherm 25P+W KL15
according to EN771-1
Length/width/height 373 mm/250 mm/238 mm
$f_b \geq 12$ N/mm² / $\rho \geq 0{,}9$ kg/dm³

Brick no. 5



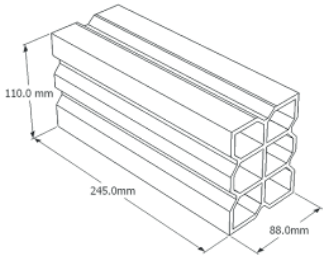
Hollow clay brick HlzW 6-0,7-8DF
according to EN771-1
Length/width/height 250 mm/240 mm/240 mm
$f_b \geq 6$ N/mm² / $\rho \geq 0{,}8$ kg/dm

Brick no. 6



Solid sand lime brick KS 12-2,0-NF
according to EN771-2
Length/width/height 240 mm/115 mm/70 mm
$f_b \geq 12$ N/mm² / $\rho \geq 2{,}0$ kg/dm³

Brick no. 7



Hollow clay brick Hueco Doble
according to EN771-1
Length/width/height 245 mm/110 mm/88 mm
$f_b \geq 2{,}5$ N/mm² / $\rho \geq 0{,}74$ kg/dm³

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PART II. POST-INSTALLATION OF REINFORCEMENT BARS

According to ETA 22/0326 in accordance with EAD 330087-01-0601 ø8 -ø20 for post-installed reinforcement connections in existing structures of normal weight concrete.

II.1 PROCESSING

II.1.1 Necessary accessories

- Standard caulking gun (manual, pneumatic, or electric)
- Static mixing nozzle (2 pieces included per cartridge)
- Blow pump and cleaning brush
- Reinforcement bars made of steel with a diameter of 8 to 20 mm
- Tape or marker

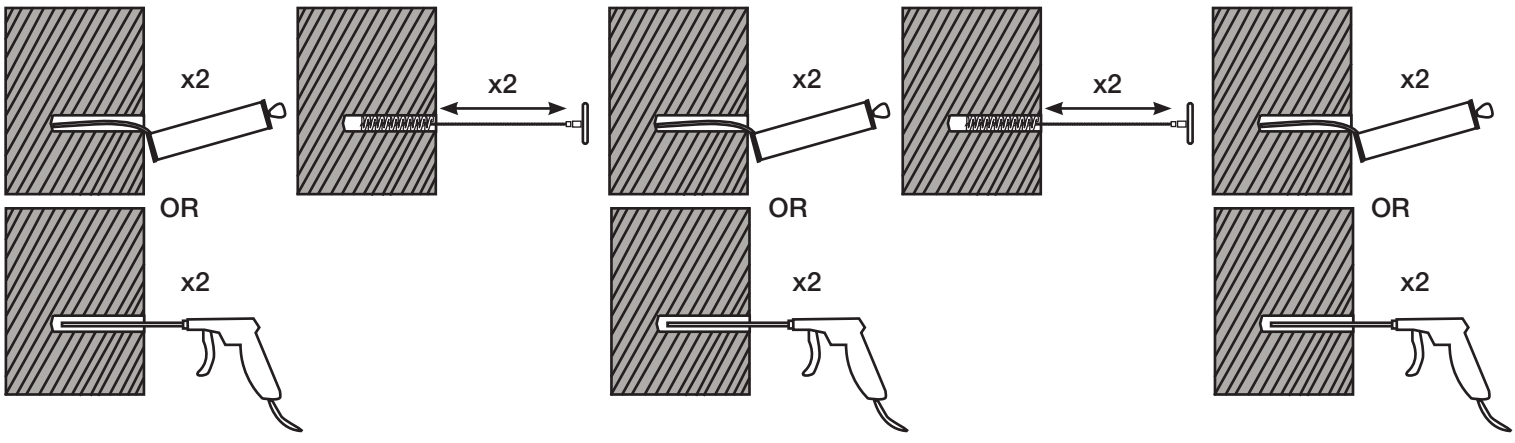
II.1.2 Preparation

1. In the case of a **carbonized surface of the existing concrete structure**, the carbonized layer must be removed around the location where the hole is drilled in a circle with a diameter $\mathbf{d_s}$ + 60 mm. The above can be neglected if building components are new and not carbonized.

2. Use a hammer drill equipped with a carbide drill in rotary mode or a compressed air drill for drilling the holes. **Drill the hole with the correct diameter to the required embedding depth.** Pay attention to concrete cover c, as indicated in the installation parameters. Drill parallel to the edge and to existing reinforcement. In case of a failed borehole, the hole must be filled with mortar.

3. **Thoroughly clean the hole.** For cleaning, the borehole must be free of water. For holes with a depth of 300 mm or less, manual cleaning can be done with a blow pump. Cleaning with compressed air can be done for all diameters of the drill holes. Use a brush with the same diameter as the drill hole and use clean compressed air.

   Blow clean 2 times, then brush clean 2 times with the cleaning brush in a back-and-forth motion, repeat these steps (blow clean 2 times, brush clean 2 times), and blow clean again 2 times.



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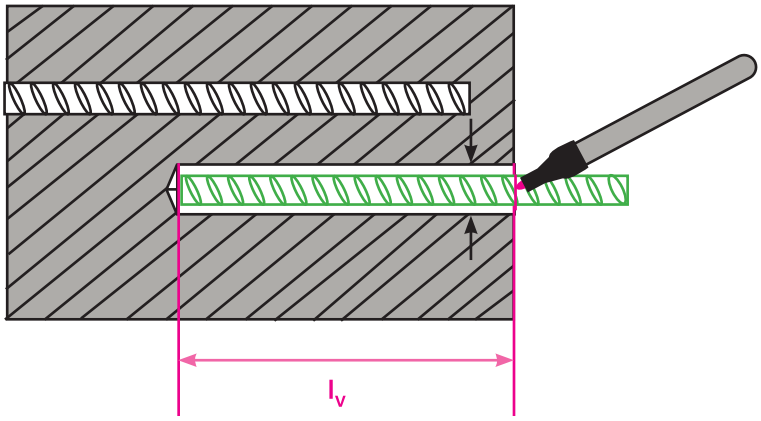
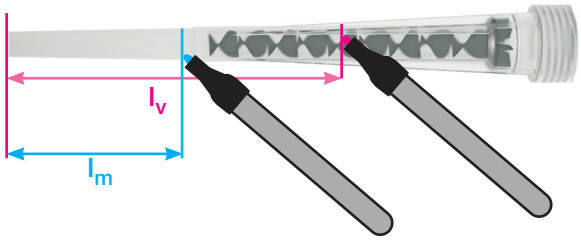
4. Place the reinforcement bar in the borehole to determine the embedment depth (l_v). Mark the embedment depth (l_v) on the reinforcement bar with tape or a marker. Remove the reinforcement bar from the borehole.

5. Mark the same embedment depth on the static mixing tip with tape or a marker, as well as the length of the required mortar level (l_m). The required mortar level should be approximately 1/2 to 3/4 of the embedment depth.



6. Turn the cap of the cartridge and screw the static mixing tip onto the mouth of the cartridge. Place the cartridge in the caulking gun. Dispense the first portion until a uniform color is achieved, and there are no streaks in the product."



II.1.3 Injecting chemical anchor

7. If there is water present in the hole after the initial cleaning, remove this water before injecting.

8. Insert the static mixing tip until it reaches the bottom of the borehole. Start dispensing the product and slowly withdraw the static mixing tip from the borehole, ensuring no air voids are created. Fill the borehole up to the indicated mortar level (l_m) on the mixing tip. This is approximately ½ to ¾ of the borehole. Then remove the static mixing tip.

II.1.4 Insert the reinforcing bar

9. Bring the clean* reinforcing bar immediately to the bottom of the hole. Do this in a back-and-forth rotating motion, ensuring that all wires on the bar are thoroughly covered with the chemical anchor. During the specified working time (see table), the reinforcing bar must be accurately positioned. (*Free from oil and other release agents).

10. All excess product must be uniformly displaced from the hole around the reinforcing bar by inserting it, indicating that the hole is full. The excess product must be removed around the opening of the hole before it hardens.

11. Allow the chemical anchor to cure. Do not manipulate the anchor until the appropriate loading time has passed (depending on the substrate and ambient temperature).

12. Leave the static mixing tip on the cartridge and replace it with a new mixing tip just before the next application.

II.1.5 Working and loading times

Temperature of resin cartridge and base material	Working time (Before blue turns to grey)	Loading time (Minimum time required until load can be applied)
-5°C » +0°C*	28 min.**	360 min.**
+0°C » +5°C*	18 min.	255 min.
+5°C » +10°C	10 min.	145 min.
+10°C » +20°C	6 min.	85 min.
+20°C » +25°C	5 min.	50 min.
+25°C » +30°C	4 min.	40 min.
+30°C » +35°C	2 min.**	35 min.**
+35°C » +40°C	1 min.**	25 min.**

T work is typical gel time at highest temperature. T load is set at the lowest temperature.
*Cartridge temperature may not be lower than +5°C.
**Not part of ETA.

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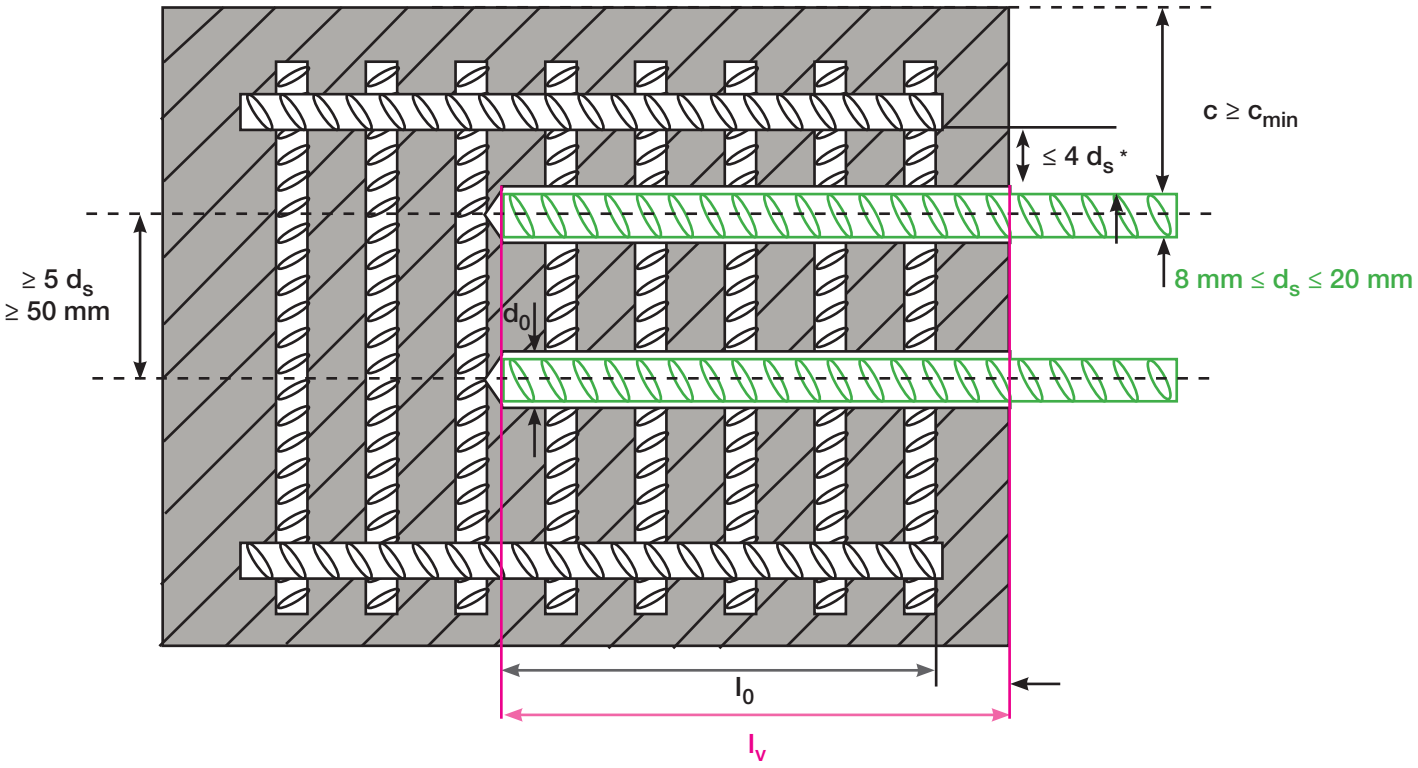
II.2.1 General design for the construction of embedded reinforcement bars



PIR	Post-installed rebar
d_s (mm)	Diameter of the reinforcement bar
d_o (mm)	Nominal borehole diameter
d_b (mm)	Diameter of the cleaning brush
c_{min}	Minimum concrete cover (see Table II.2.2)
$l_{b,\,min}$	Minimum anchorage length according to EN1992-1-1, equation 8.6
$l_{o,\,min}$	Minimum overlap length according to EN1992-1-1, equation 8.11
l_v	Embedment depth

* If the free distance between overlapping bars is greater than $4d_S$, the overlap length must be increased by the difference between the free distance of the bars and $4d_S$.

II.2.2 Installation parameters

Reinforcement bar		ø 8	ø 10	ø 12	ø 14	ø 16	ø 20
Nominal diameter of the reinforcement bar	$d_{min,\ PIR}$ (mm)	8	10	12	14	16	20
Maximum outer diameter of the reinforcement bar, including ribs	$d_{max,\ PIR}$ (mm)	9,6	12	14,4	16,8	19,2	24
Nominal bore diameter	d_0 (mm)	12	14	16	18	20	25
Diameter of the cleaning brush	d_b (mm)	14	14	20	22	22	30
Maximum allowable anchoring depth	$l_{v,\ max}$ (mm)	400	500	600	700	800	1000
Anchoring length	l_b (mm)	$1{,}5 \bullet l_{b,\ min}$					
Overlap length	l_o (mm)	$1{,}5 \bullet l_{o,\ min}$					
Minimum concrete cover for hammer drilling without drill guide	c_{min} (mm)	$30\ mm + 0{,}06\ l_v \geq 2\ d_{PIR}$					
Minimum concrete cover for hammer drilling with drill guide	c_{min} (mm)	$30\ mm + 0{,}02\ l_v \geq 2\ d_{PIR}$					
Minimum concrete cover for pneumatic drilling with drill guide	c_{min} (mm)	$50\ mm + 0{,}08\ l_v$					
Minimum concrete cover for pneumatic drilling without drill guide	c_{min} (mm)	$50\ mm + 0{,}02\ l_v$					

II.2.3 Design characteristic bond strength of reinforcement bars for a service life of 100 years

ø 8 - ø 16									
Factor for concrete	C12/15	C16/20	C20/25	C25/30	C30/37	C35/45	C40/50	C45/55	C50/60
k_b	1,0	1,0	1,0	1,0	0,89	0,80	0,73	0,67	0,63
$f_{bd,\ PIR}$ (N/mm²)	1,6	2,0	2,3	2,7					

ø 20									
Factor for concrete	C12/15	C16/20	C20/25	C25/30	C30/37	C35/45	C40/50	C45/55	C50/60
k_b	1,0	1,0	1,0	0,86	0,76	0,69	0,63	0,58	0,63
$f_{bd,\ PIR}$ (N/mm²)	1,6	2,0	2,3						2,7

$f_{bd,\ PIR}$ $k_b \bullet f_{bd}$
k_b Reduction factor
f_{bd} Design bond strength of a post-installed reinforcement bar according to EN 1992-1-1

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