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-21/0265 of 19 May 2021

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	RESINA VINILESTER + SIN ESTIRENO LUSAN for concrete
Product family to which the construction product belongs	Bonded fastener for use in concrete
Manufacturer	LUSAN FIJACIONES Y ANCLAJES, S.L. C. / Molinos 20 29491 ALGATOCIN, MALAGA SPANIEN
Manufacturing plant	PLANT 1
This European Technical Assessment contains	28 pages including 3 annexes which form an integral part of this assessment
This European Technical Assessment is issued in accordance with Regulation (EU) No 305/2011, on the basis of	EAD 330499-01-0601, Edition 04/2020

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Specific Part

1 Technical description of the product

The "RESINA VINILESTER + SIN ESTIRENO LUSAN for concrete" is a bonded anchor consisting of a cartridge with injection mortar VINI or VININ and a steel element. The steel element consists of a commercial threaded rod with washer and hexagon nut in the range of M8 to M30 or reinforcing bar in the range of ∅ 8 to ∅ 32 mm or an internal threaded anchor rod HR-M6 to HR-M20.
The steel element is placed into a drilled hole filled with injection mortar and is anchored via the bond between metal part, injection mortar and concrete.

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 to tension load (static and quasi-static loading)	See Annex B 2, C 1 to C 3, C 5, C 7
Characteristic resistance to shear load (static and quasi-static loading)	See Annex C1, C 4, C 6, C 8
Displacements (static and quasi-static loading)	See Annex C 9 to C 11
Characteristic resistance and displacements for seismic performance categories C1	See Annex C 12 to C 16
Characteristic resistance and displacements for seismic performance categories C2	No performance assessed

3.2 Hygiene, health and the environment (BWR 3)

Essential characteristic	Performance
Content, emission and/or release of dangerous substances	No performance assessed

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

In accordance with the European Assessment Document EAD 330499-01-0601 the applicable European legal act is: [96/582/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

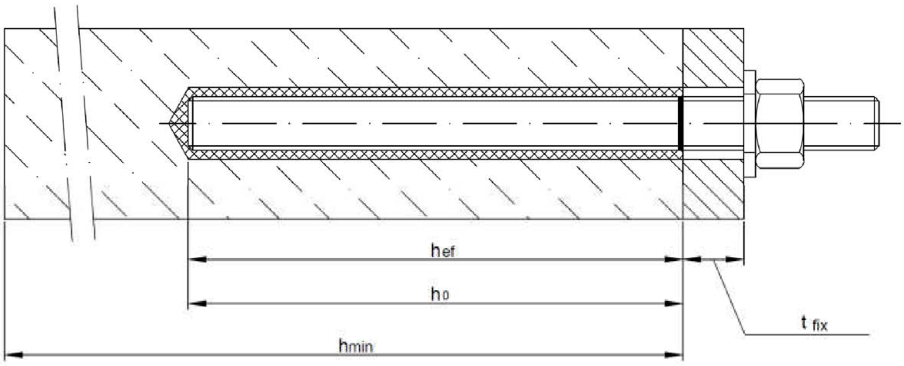
Technical details necessary for the implementation of the AVCP system are laid down in the control plan deposited at Deutsches Institut für Bautechnik.

Issued in Berlin on 19 May 2021 by Deutsches Institut für Bautechnik

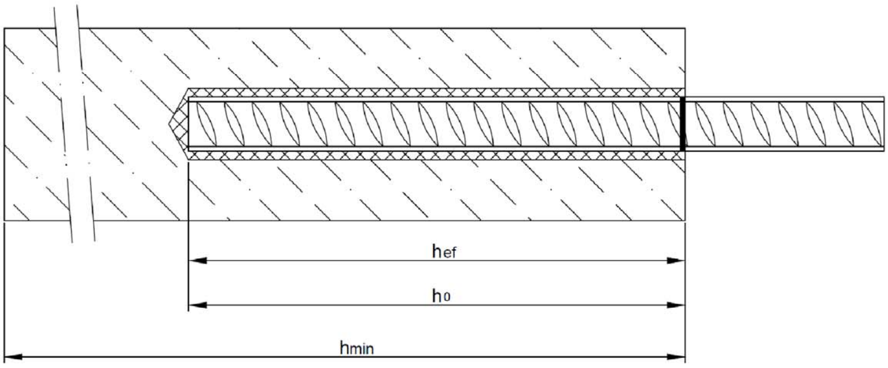
Dipl.-Ing. Beatrix Wittstock
Head of Section

beglaubigt:
Baderschneider

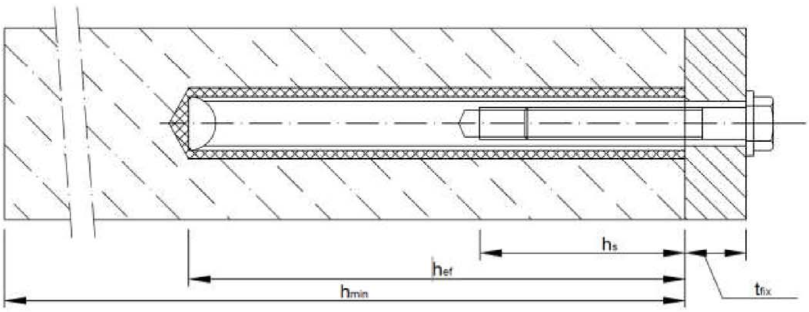
Installation threaded rod M8 up to M30



Installation reinforcing bar Ø8 up to Ø32



Installation internal threaded anchor rod HR-M6 up to HR-M20



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

RESINA VINILESTER + SIN ESTIRENO LUSAN for concrete

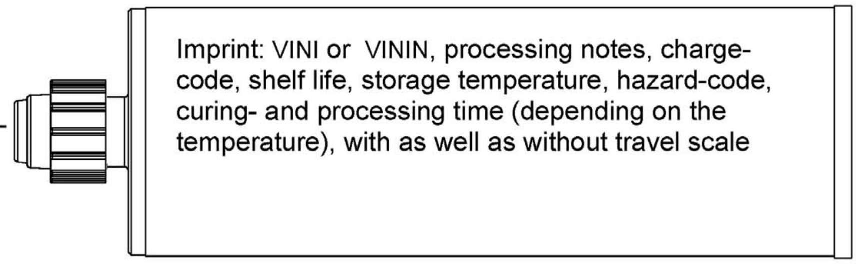
Product description
Installed condition

Annex A 1

Cartridge: VINI or VININ

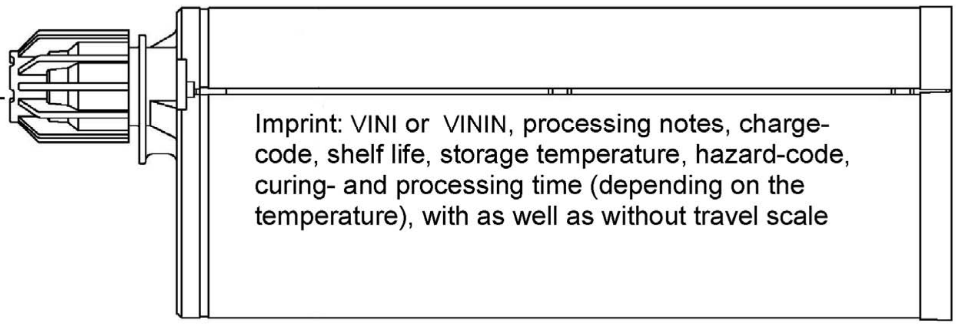
150 ml, 280 ml, 300 ml up to 333 ml and 380 ml up to 420 ml cartridge (Type: coaxial)

Sealing/Screw cap



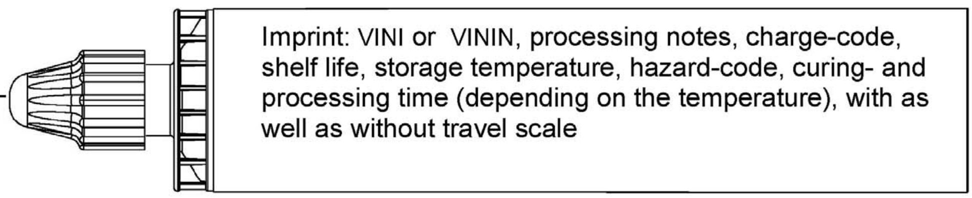
235 ml, 345 ml up to 360 ml and 825 ml cartridge (Type: “side-by-side”)

Sealing/Screw cap



165 ml and 300 ml cartridge (Type: “foil tube”)

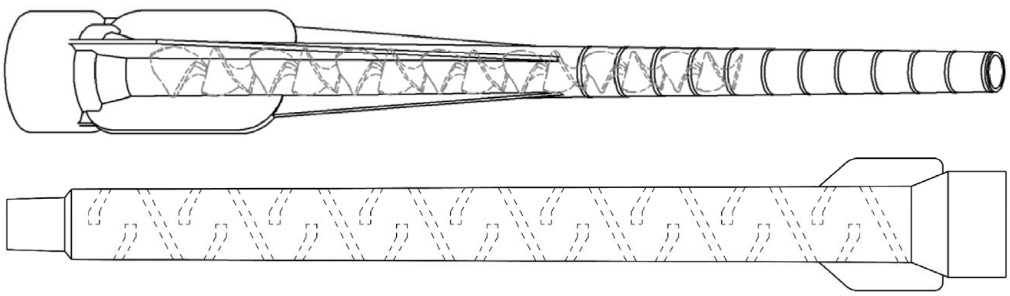
Sealing/Screw cap



Static Mixer

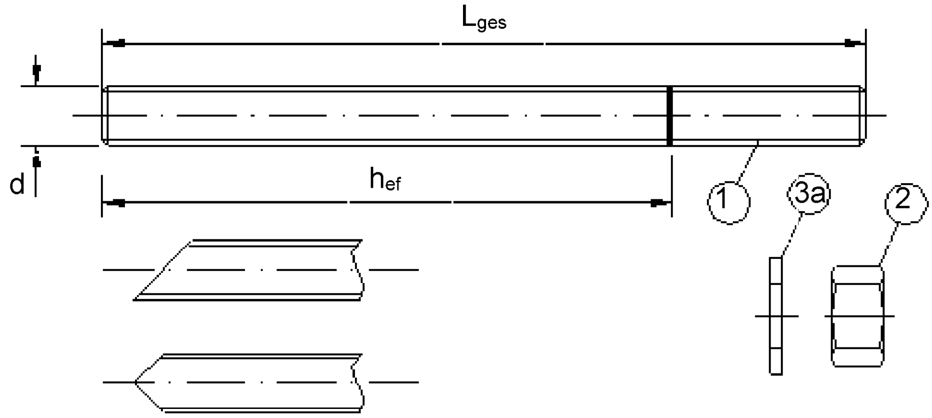
BO

BO



RESINA VINILESTER + SIN ESTIRENO LUSAN for concrete	**Annex A 2**
Product description Injection system	

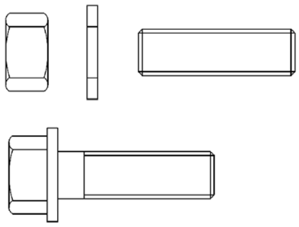
Threaded rod M8, M10, M12, M16, M20, M24, M27, M30 with washer and hexagon nut



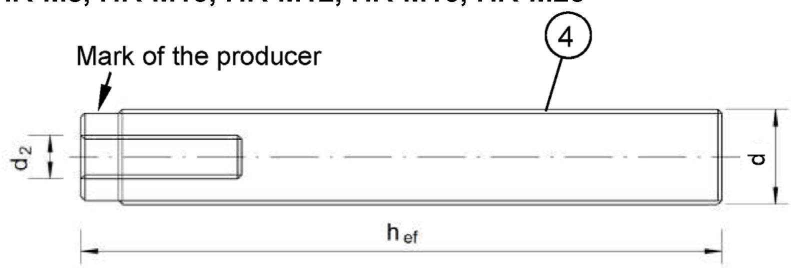
Commercial standard threaded rod with:
- Materials, dimensions and mechanical properties acc. Table A1
- Inspection certificate 3.1 acc. to EN 10204:2004
- Marking of embedment depth

Internal threaded anchor rod HR-M6, HR-M8, HR-M10, HR-M12, HR-M16, HR-M20

Threaded rod or screw



Mark of the producer



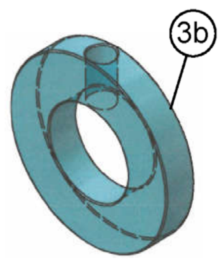
Marking: e.g. ◇I◇ M8

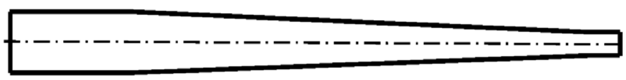
I Marking Internal thread

◇ Mark

M8 Thread size (Internal thread)
A4 additional mark for stainless steel
HCR additional mark for high-corrosion resistance steel

Filling washer and mixer reduction nozzle for filling the annular gap between anchor rod and fixture





RESINA VINILESTER + SIN ESTIRENO LUSAN for concrete	**Annex A 3**
Product description Threaded rod, internal threaded rod and filling washer	

Table A1: Materials

Part	Designation	Material				
Steel, zinc plated (Steel acc. to EN ISO 683-4:2018 or EN 10263:2001) - zinc plated ≥ 5 µm acc. to EN ISO 4042:2018 or - hot-dip galvanised ≥ 40 µm acc. to EN ISO 1461:2009 and EN ISO 10684:2004+AC:2009 or - sherardized ≥ 45 µm acc. to EN ISO 17668:2016						
1	Threaded rod	Property class		Characteristic tensile strength	Characteristic yield strength	Elongation at fracture
		acc. to EN ISO 898-1:2013	4.6	f_{uk} = 400 N/mm²	f_{yk} = 240 N/mm²	A_5 > 8%
			4.8	f_{uk} = 400 N/mm²	f_{yk} = 320 N/mm²	A_5 > 8%
			5.6	f_{uk} = 500 N/mm²	f_{yk} = 300 N/mm²	A_5 > 8%
			5.8	f_{uk} = 500 N/mm²	f_{yk} = 400 N/mm²	A_5 > 8%
			8.8	f_{uk} = 800 N/mm²	f_{yk} = 640 N/mm²	A_5 ≥ 8%
2	Hexagon nut	acc. to EN ISO 898-2:2012	4	for threaded rod class 4.6 or 4.8		
			5	for threaded rod class 5.6 or 5.8		
			8	for threaded rod class 8.8		
3a	Washer	Steel, zinc plated, hot-dip galvanised or sherardized (e.g.: EN ISO 887:2006, EN ISO 7089:2000, EN ISO 7093:2000 or EN ISO 7094:2000)				
3b	Filling washer	Steel, zinc plated, hot-dip galvanised or sherardized				
4	Internal threaded anchor rod	Property class		Characteristic tensile strength	Characteristic yield strength	Elongation at fracture
		acc. to EN ISO 898-1:2013	5.8	f_{uk} = 500 N/mm²	f_{yk} = 400 N/mm²	A_5 > 8%
			8.8	f_{uk} = 800 N/mm²	f_{yk} = 640 N/mm²	A_5 > 8%
Stainless steel A2 (Material 1.4301 / 1.4307 / 1.4311 / 1.4567 or 1.4541, acc. to EN 10088-1:2014) **Stainless steel A4** (Material 1.4401 / 1.4404 / 1.4571 / 1.4362 or 1.4578, acc. to EN 10088-1:2014) **High corrosion resistance steel** (Material 1.4529 or 1.4565, acc. to EN 10088-1: 2014)						
1	Threaded rod[1)3)]	Property class		Characteristic tensile strength	Characteristic yield strength	Elongation at fracture
		acc. to EN ISO 3506-1:2020	50	f_{uk} = 500 N/mm²	f_{yk} = 210 N/mm²	A_5 ≥ 8%
			70	f_{uk} = 700 N/mm²	f_{yk} = 450 N/mm²	A_5 ≥ 8%
			80	f_{uk} = 800 N/mm²	f_{yk} = 600 N/mm²	A_5 ≥ 8%
2	Hexagon nut [1)3)]	acc. to EN ISO 3506-1:2020	50	for threaded rod class 50		
			70	for threaded rod class 70		
			80	for threaded rod class 80		
3a	Washer	A2: Material 1.4301 / 1.4307 / 1.4311 / 1.4567 or 1.4541, acc. to EN 10088-1:2014 A4: Material 1.4401 / 1.4404 / 1.4571 / 1.4362 or 1.4578, acc. to EN 10088-1:2014 HCR: Material 1.4529 or 1.4565, acc. to EN 10088-1: 2014 (e.g.: EN ISO 887:2006, EN ISO 7089:2000, EN ISO 7093:2000 or EN ISO 7094:2000)				
3b	Filling washer	Stainless steel A4, High corrosion resistance steel				
		Property class		Characteristic tensile strength	Characteristic yield strength	Elongation at fracture
4	Internal threaded anchor rod[1)2)]	acc. to EN ISO 3506-1:2020	50	f_{uk} = 500 N/mm²	f_{yk} = 210 N/mm²	A_5 > 8%
			70	f_{uk} = 700 N/mm²	f_{yk} = 450 N/mm²	A_5 > 8%

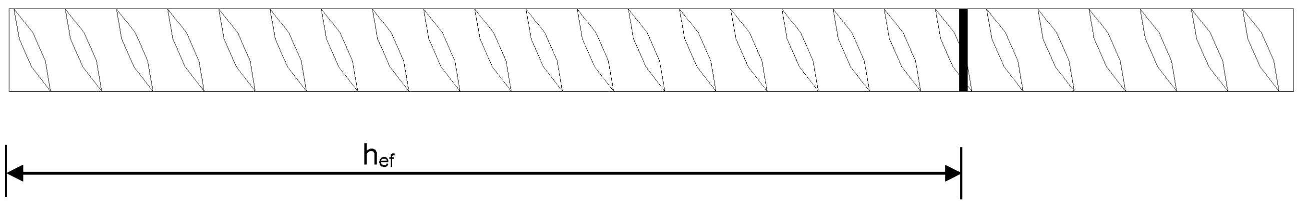
[1)] Property class 70 for threaded rods up to M24 and Internal threaded anchor rods up to HR-M16,
[2)] for HR-M20 only property class 50
[3)] Property class 80 only for stainless steel A4

RESINA VINILESTER + SIN ESTIRENO LUSAN for concrete

Product description
Materials threaded rod and internal threaded rod

Annex A 4

Reinforcing bar ∅ 8, ∅ 10, ∅ 12, ∅ 14, ∅ 16, ∅ 20, ∅ 25, ∅ 28, ∅ 32



- Minimum value of related rip area $f_{R,min}$ according to EN 1992-1-1:2004+AC:2010
- Rib height of the bar shall be in the range 0,05d ≤ h ≤ 0,07d
  (d: Nominal diameter of the bar; h: Rip height of the bar)

Table A2: Materials

Part	Designation	Material
Reinforcing bars		
1	Rebar EN 1992-1-1:2004+AC:2010, Annex C	Bars and de-coiled rods class B or C f_{yk} and k according to NDP or NCL of EN 1992-1-1/NA $f_{uk} = f_{tk} = k \cdot f_{yk}$

RESINA VINILESTER + SIN ESTIRENO LUSAN for concrete

Product description
Materials reinforcing bar

Annex A 5

Specifications of intended use

Anchorages subject to:

- Static and quasi-static loads: M8 to M30, Rebar Ø8 to Ø32, HR-M6 to HR-M20.
- Seismic action for Performance Category C1: M8 to M30, Rebar Ø8 to Ø32.

Base materials:

- Compacted, reinforced or unreinforced normal weight concrete without fibres according to EN 206:2013 + A1:2016.
- Strength classes C20/25 to C50/60 according to EN 206:2013 + A1:2016.
- Uncracked concrete: M8 to M30, Rebar Ø8 to Ø32, HR-M6 to HR-M20.
- Cracked concrete: M8 to M30, Rebar Ø8 to Ø32, HR-M6 to HR-M20.

Temperature Range:

- I: - 40 °C to +40 °C (max long term temperature +24 °C and max short term temperature +40 °C)
- II: - 40 °C to +80 °C (max long term temperature +50 °C and max short term temperature +80 °C)
- III: - 40 °C to +120 °C (max long term temperature +72 °C and max short term temperature +120 °C)

Use conditions (Environmental conditions):

- Structures subject to dry internal conditions (all materials).
- For all other conditions according to EN 1993-1-4:2006+A1:2015 corresponding to corrosion resistance class:
  - Stainless steel Stahl A2 according to Annex A 4, Table A1: CRC II
  - Stainless steel Stahl A4 according to Annex A 4, Table A1: CRC III
  - High corrosion resistance steel HCR according to Annex A 4, Table A1: CRC V

Design:

- Verifiable calculation notes and drawings are prepared taking account of the loads to be anchored. The position of the anchor is indicated on the design drawings (e. g. position of the anchor relative to reinforcement or to supports, etc.).
- Anchorages are designed under the responsibility of an engineer experienced in anchorages and concrete work.
- The anchorages are designed in accordance to EN 1992-4:2018 and Technical Report TR055, Edition February 2018

Installation:

- Dry or wet concrete: M8 to M30, Rebar Ø8 to Ø32, HR-M6 to HR-M20.
- Flooded holes (not sea water): M8 to M16, Rebar Ø8 to Ø16, HR-M6 to HR-M10.
- Hole drilling by hammer (HD), hollow (HDB) or compressed air drill mode (CD).
- Overhead installation allowed.
- Anchor installation carried out by appropriately qualified personnel and under the supervision of the person responsible for technical matters of the site.
- The injection mortar is assessed for installation at minimum concrete temperature of -10°C resp. -20°C, where subsequently the temperature in the concrete does not rise at a rapid rate, i.e. from the minimum installation temperature to 24°C within a 12-hour period.

RESINA VINILESTER + SIN ESTIRENO LUSAN for concrete	**Annex B 1**
Intended Use Specifications	

Table B1: Installation parameters for threaded rod

Anchor size		**M8**	**M10**	**M12**	**M16**	**M20**	**M24**	**M27**	**M30**
Outer diameter of anchor	d_{nom} [mm] =	8	10	12	16	20	24	27	30
Nominal drill hole diameter	d_0 [mm] =	10	12	14	18	24	28	32	35
Effective embedment depth	$h_{ef,min}$ [mm] =	60	60	70	80	90	96	108	120
	$h_{ef,max}$ [mm] =	160	200	240	320	400	480	540	600
Diameter of clearance hole in the fixture	d_f [mm] ≤	9	12	14	18	22	26	30	33
Diameter of steel brush	d_b [mm] ≥	12	14	16	20	26	30	34	37
Maximum torque moment	max T_{inst} [Nm] ≤	10	20	40	80	120	160	180	200
Minimum thickness of member	h_{min} [mm]	h_{ef} + 30 mm ≥ 100 mm			$h_{ef} + 2d_0$				
Minimum spacing	s_{min} [mm]	40	50	60	80	100	120	135	150
Minimum edge distance	c_{min} [mm]	40	50	60	80	100	120	135	150

Table B2: Installation parameters for rebar

Rebar size		**Ø 8**	**Ø 10**	**Ø 12**	**Ø 14**	**Ø 16**	**Ø 20**	**Ø 25**	**Ø 28**	**Ø 32**
Outer diameter of anchor	d_{nom} [mm] =	8	10	12	14	16	20	25	28	32
Nominal drill hole diameter	d_0 [mm] =	12	14	16	18	20	24	32	35	40
Effective embedment depth	$h_{ef,min}$ [mm] =	60	60	70	75	80	90	100	112	128
	$h_{ef,max}$ [mm] =	160	200	240	280	320	400	500	580	640
Diameter of steel brush	d_b [mm] ≥	14	16	18	20	22	26	34	37	41,5
Minimum thickness of member	h_{min} [mm]	h_{ef} + 30 mm ≥ 100 mm		$h_{ef} + 2d_0$						
Minimum spacing	s_{min} [mm]	40	50	60	70	80	100	125	140	160
Minimum edge distance	c_{min} [mm]	40	50	60	70	80	100	125	140	160

Table B3: Installation parameters for internal threaded anchor rod

Size internal threaded anchor rod		**HR-M6**	**HR-M8**	**HR-M10**	**HR-M12**	**HR-M16**	**HR-M20**
Internal diameter of anchor	d_2 [mm] =	6	8	10	12	16	20
Outer diameter of anchor [1)]	d_{nom} [mm] =	10	12	16	20	24	30
Nominal drill hole diameter	d_0 [mm] =	12	14	18	22	28	35
Effective embedment depth	$h_{ef,min}$ [mm] =	60	70	80	90	96	120
	$h_{ef,max}$ [mm] =	200	240	320	400	480	600
Diameter of clearance hole in the fixture	d_f [mm] =	7	9	12	14	18	22
Maximum torque moment	max T_{inst} [Nm] ≤	10	10	20	40	60	100
Thread engagement length min/max	l_{IG} [mm] =	8/20	8/20	10/25	12/30	16/32	20/40
Minimum thickness of member	h_{min} [mm]	h_{ef} + 30 mm ≥ 100 mm		$h_{ef} + 2d_0$			
Minimum spacing	s_{min} [mm]	50	60	80	100	120	150
Minimum edge distance	c_{min} [mm]	50	60	80	100	120	150

[1)] With metric threads according to EN 1993-1-8:2005+AC:2009

RESINA VINILESTER + SIN ESTIRENO LUSAN for concrete

Intended Use
Installation parameters

Annex B 2

Table B4: Parameter cleaning and setting tools






Threaded Rod	Rebar	Internal threaded Anchor rod	d_0 Drill bit - Ø HD, HDB, CA	d_b Brush - Ø		$d_{b,min}$ min. Brush - Ø	Piston plug	Installation direction and use of piston plug		
[mm]	[mm]	[mm]	[mm]		[mm]	[mm]		⬇	➡	⬆
M8			10	C1-10	12	10,5	No piston plug required			
M10	8	HR-M6	12	C1-12	14	12,5				
M12	10	HR-M8	14	C1-14	16	14,5				
	12		16	C1-16	18	16,5				
M16	14	HR-M10	18	C1-18	20	18,5	VS18	h_{ef} > 250 mm	h_{ef} > 250 mm	all
	16		20	C1-20	22	20,5	VS20			
M20	20	HR-M12	24	C1-24	26	24,5	VS24			
M24		HR-M16	28	C1-28	30	28,5	VS28			
M27	25		32	C1-32	34	32,5	VS32			
M30	28	HR-M20	35	C1-35	37	35,5	VS35			
	32		40	C1-40	41,5	40,5	VS40			

MAC - Hand pump (volume 750 ml)
Drill bit diameter (d_0): 10 mm to 20 mm
Drill hole depth (h_0): < 10 d_{nom}
Only in uncracked concrete

CAC - Rec. compressed air tool (min 6 bar)
Drill bit diameter (d_0): all diameters

Piston plug for overhead or horizontal installation VS
Drill bit diameter (d_0): 18 mm to 40 mm

d_b

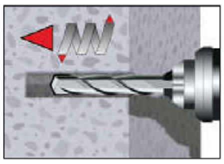
Steel brush C1-
Drill bit diameter (d_0): all diameters

RESINA VINILESTER + SIN ESTIRENO LUSAN for concrete	**Annex B 3**
Intended Use Cleaning and setting tools	

Deutsches Institut für Bautechnik DIBt

Installation instructions

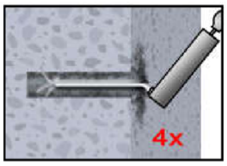
Drilling of the bore hole



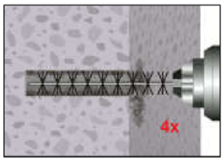
1. Drill with hammer drill a hole into the base material to the size and embedment depth required by the selected anchor (Table B1, B2, or B3), with hammer (HD), hollow (HDB) or compressed air (CD) drilling. The use of a hollow drill bit is only in combination with a sufficient vacuum permitted.
In case of aborted drill hole: The drill hole shall be filled with mortar

Attention! Standing water in the bore hole must be removed before cleaning.

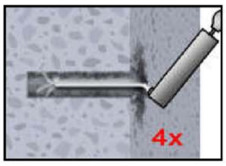
MAC: Cleaning for bore hole diameter $d_0 \leq$ 20mm and bore hole depth $h_0 \leq 10d_{nom}$ (uncracked concrete only!)



2a. Starting from the bottom or back of the bore hole, blow the hole clean by a hand pump [1] (Annex B 3) a minimum of four times.



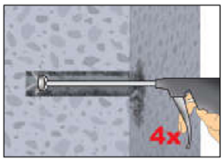
2b. Check brush diameter (Table B4). Brush the hole with an appropriate sized wire brush > $d_{b,min}$ (Table B4) a minimum of four times in a twisting motion.
If the bore hole ground is not reached with the brush, a brush extension must be used.



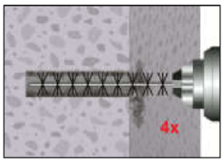
2c. Finally blow the hole clean again with a hand pump (Annex B 3) a minimum of four times.

[1] It is permitted to blow bore holes with diameter between 14 mm and 20 mm and an embedment depth up to $10d_{nom}$ also in cracked concrete with hand-pump.

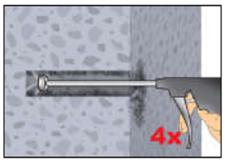
CAC: Cleaning for all bore hole diameter in uncracked and cracked concrete



2a. Starting from the bottom or back of the bore hole, blow the hole clean with compressed air (min. 6 bar) (Annex B 3) a minimum of four times until return air stream is free of noticeable dust. If the bore hole ground is not reached an extension must be used.



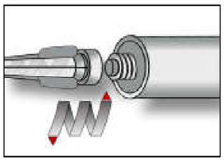
2b. Check brush diameter (Table B4). Brush the hole with an appropriate sized wire brush > $d_{b,min}$ (Table B4) a minimum of four times in a twisting motion.
If the bore hole ground is not reached with the brush, a brush extension must be used.



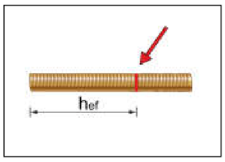
2c. Finally blow the hole clean again with compressed air (min. 6 bar) (Annex B 3) a minimum of four times until return air stream is free of noticeable dust. If the bore hole ground is not reached an extension must be used.

**After cleaning, the bore hole has to be protected against re-contamination in an appropriate way, until dispensing the mortar in the bore hole. If necessary, the cleaning has to be repeated directly before dispensing the mortar.
In-flowing water must not contaminate the bore hole again.**

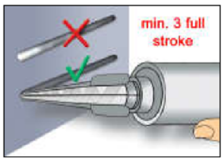
Installation instructions (continuation)



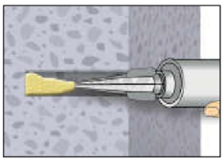
3. Attach the supplied static-mixing nozzle to the cartridge and load the cartridge into the correct dispensing tool. Cut off the foil tube clip before use.
For every working interruption longer than the recommended working time (Annex B 6) as well as for new cartridges, a new static-mixer shall be used.



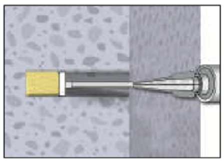
4. Prior to inserting the anchor rod into the filled bore hole, the position of the embedment depth shall be marked on the anchor rods.



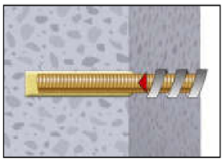
5. Prior to dispensing into the anchor hole, squeeze out separately a minimum of three full strokes and discard non-uniformly mixed adhesive components until the mortar shows a consistent grey colour. For foil tube cartridges it must be discarded a minimum of six full strokes.



6. Starting from the bottom or back of the cleaned anchor hole, fill the hole up to approximately two-thirds with adhesive. Slowly withdraw the static mixing nozzle as the hole fills to avoid creating air pockets. If the bottom or back of the anchor hole is not reached, an appropriate extension nozzle must be used. Observe the gel-/ working times given in Annex B 6.

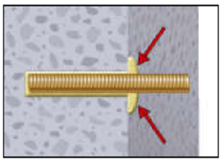


7. Piston plugs and mixer nozzle extensions shall be used according to Table B4 for the following applications:
   - Horizontal assembly (horizontal direction) and ground erection (vertical downwards direction): Drill bit-Ø $d_0 \geq 18$ mm and embedment depth $h_{ef} > 250$mm
   - Overhead assembly (vertical upwards direction): Drill bit-Ø $d_0 \geq 18$ mm

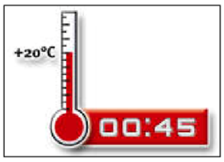


8. Push the threaded rod or reinforcing bar into the anchor hole while turning slightly to ensure positive distribution of the adhesive until the embedment depth is reached.

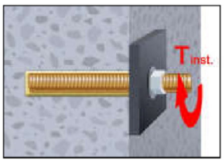
   The anchor shall be free of dirt, grease, oil or other foreign material.



9. Be sure that the anchor is fully seated at the bottom of the hole and that excess mortar is visible at the top of the hole. If these requirements are not maintained, the application has to be renewed. For overhead application the anchor rod shall be fixed (e.g. wedges).



10. Allow the adhesive to cure to the specified time prior to applying any load or torque. Do not move or load the anchor until it is fully cured (attend Annex B 6).



11. After full curing, the add-on part can be installed with up to the max. torque (Table B1 or B3) by using a calibrated torque wrench. It can be optional filled the annular gap between anchor and fixture with mortar. Therefor substitute the washer by the filling washer and connect the mixer reduction nozzle to the tip of the mixer. The annular gap is filled with mortar, when mortar oozes out of the washer.

RESINA VINILESTER + SIN ESTIRENO LUSAN for concrete	**Annex B 5**
Intended Use Installation instructions (continuation)	

Table B5: Maximum working time and minimum curing time VINI

Concrete temperature	Gelling- / working time	Minimum curing time in dry concrete [1)]
-10 °C to -6°C	90 min[2)]	24 h[2)]
-5 °C to -1°C	90 min	14 h
0 °C to +4°C	45 min	7 h
+5 °C to +9°C	25 min	2 h
+ 10 °C to +19°C	15 min	80 min
+ 20 °C to +29°C	6 min	45 min
+ 30 °C to +34°C	4 min	25 min
+ 35 °C to +39°C	2 min	20 min
+ 40 °C	1,5 min	15 min
Cartridge temperature	+5°C to +40°C	

1) In wet concrete the curing time must be doubled.
2) Cartridge temperature must be at min. +15°C.

Table B6: Maximum working time and minimum curing time VININ

Concrete temperature	Gelling- / working time	Minimum curing time in dry concrete [1)]
-20 °C to -16°C	75 min	24 h
-15 °C to -11°C	55 min	16 h
-10 °C to -6°C	35 min	10 h
-5 °C to -1°C	20 min	5 h
0 °C to +4°C	10 min	2,5 h
+5 °C to +9°C	6 min	80 Min
+ 10 °C	6 min	60 Min
Cartridge temperature	-20°C to +10°C	

1) In wet concrete the curing time must be doubled.

RESINA VINILESTER + SIN ESTIRENO LUSAN for concrete

Intended Use
Curing time

Annex B 6

Table C1: Characteristic values for steel tension resistance and steel shear resistance of threaded rods

Size				M8	M10	M12	M16	M20	M24	M27	M30
Cross section area		A_s	[mm²]	36,6	58	84,3	157	245	353	459	561
Characteristic tension resistance, Steel failure [1)]											
Steel, Property class 4.6 and 4.8		$N_{Rk,s}$	[kN]	15 (13)	23 (21)	34	63	98	141	184	224
Steel, Property class 5.6 and 5.8		$N_{Rk,s}$	[kN]	18 (17)	29 (27)	42	78	122	176	230	280
Steel, Property class 8.8		$N_{Rk,s}$	[kN]	29 (27)	46 (43)	67	125	196	282	368	449
Stainless steel A2, A4 and HCR, class 50		$N_{Rk,s}$	[kN]	18	29	42	79	123	177	230	281
Stainless steel A2, A4 and HCR, class 70		$N_{Rk,s}$	[kN]	26	41	59	110	171	247	-[3)]	-[3)]
Stainless steel A4 and HCR, class 80		$N_{Rk,s}$	[kN]	29	46	67	126	196	282	-[3)]	-[3)]
Characteristic tension resistance, Partial factor [2)]											
Steel, Property class 4.6 and 5.6		$\gamma_{Ms,N}$	[-]	2,0							
Steel, Property class 4.8, 5.8 and 8.8		$\gamma_{Ms,N}$	[-]	1,5							
Stainless steel A2, A4 and HCR, class 50		$\gamma_{Ms,N}$	[-]	2,86							
Stainless steel A2, A4 and HCR, class 70		$\gamma_{Ms,N}$	[-]	1,87							
Stainless steel A4 and HCR, class 80		$\gamma_{Ms,N}$	[-]	1,6							
Characteristic shear resistance, Steel failure [1)]											
Without lever arm	Steel, Property class 4.6 and 4.8	$V^0_{Rk,s}$	[kN]	9 (8)	14 (13)	20	38	59	85	110	135
	Steel, Property class 5.6 and 5.8	$V^0_{Rk,s}$	[kN]	11 (10)	17 (16)	25	47	74	106	138	168
	Steel, Property class 8.8	$V^0_{Rk,s}$	[kN]	15 (13)	23 (21)	34	63	98	141	184	224
	Stainless steel A2, A4 and HCR, class 50	$V^0_{Rk,s}$	[kN]	9	15	21	39	61	88	115	140
	Stainless steel A2, A4 and HCR, class 70	$V^0_{Rk,s}$	[kN]	13	20	30	55	86	124	-[3)]	-[3)]
	Stainless steel A4 and HCR, class 80	$V^0_{Rk,s}$	[kN]	15	23	34	63	98	141	-[3)]	-[3)]
With lever arm	Steel, Property class 4.6 and 4.8	$M^0_{Rk,s}$	[Nm]	15 (13)	30 (27)	52	133	260	449	666	900
	Steel, Property class 5.6 and 5.8	$M^0_{Rk,s}$	[Nm]	19 (16)	37 (33)	65	166	324	560	833	1123
	Steel, Property class 8.8	$M^0_{Rk,s}$	[Nm]	30 (26)	60 (53)	105	266	519	896	1333	1797
	Stainless steel A2, A4 and HCR, class 50	$M^0_{Rk,s}$	[Nm]	19	37	66	167	325	561	832	1125
	Stainless steel A2, A4 and HCR, class 70	$M^0_{Rk,s}$	[Nm]	26	52	92	232	454	784	-[3)]	-[3)]
	Stainless steel A4 and HCR, class 80	$M^0_{Rk,s}$	[Nm]	30	59	105	266	519	896	-[3)]	-[3)]
Characteristic shear resistance, Partial factor [2)]											
Steel, Property class 4.6 and 5.6		$\gamma_{Ms,V}$	[-]	1,67							
Steel, Property class 4.8, 5.8 and 8.8		$\gamma_{Ms,V}$	[-]	1,25							
Stainless steel A2, A4 and HCR, class 50		$\gamma_{Ms,V}$	[-]	2,38							
Stainless steel A2, A4 and HCR, class 70		$\gamma_{Ms,V}$	[-]	1,56							
Stainless steel A4 and HCR, class 80		$\gamma_{Ms,V}$	[-]	1,33							

[1)] Values are only valid for the given stress area A_s. Values in brackets are valid for undersized threaded rods with smaller stress area A_s for hot-dip galvanised threaded rods according to EN ISO 10684:2004+AC:2009.
[2)] in absence of national regulation
[3)] Anchor type not part of the ETA

RESINA VINILESTER + SIN ESTIRENO LUSAN for concrete

Performances
Characteristic values for steel tension resistance and steel shear resistance of threaded rods

Annex C 1

Table C2: Characteristic values for Concrete cone failure and Splitting with all kind of action

Anchor size				**All Anchor types and sizes**
Concrete cone failure				
Uncracked concrete		$k_{ucr,N}$	[-]	11,0
Cracked concrete		$k_{cr,N}$	[-]	7,7
Edge distance		$c_{cr,N}$	[mm]	1,5 h_{ef}
Axial distance		$s_{cr,N}$	[mm]	2 $c_{cr,N}$
Splitting				
Edge distance	$h/h_{ef} \geq 2,0$	$c_{cr,sp}$	[mm]	1,0 h_{ef}
	$2,0 > h/h_{ef} > 1,3$			$2 \cdot h_{ef} \left(2,5 - \frac{h}{h_{ef}}\right)$
	$h/h_{ef} \leq 1,3$			2,4 h_{ef}
Axial distance		$s_{cr,sp}$	[mm]	2 $c_{cr,sp}$

RESINA VINILESTER + SIN ESTIRENO LUSAN for concrete	**Annex C 2**
Performances Characteristic values for Concrete cone failure and Splitting with all kind of action	

Table C3: Characteristic values of tension loads under static and quasi-static action

Anchor size threaded rod					M8	M10	M12	M16	M20	M24	M27	M30
Steel failure												
Characteristic tension resistance			$N_{Rk,s}$	[kN]	$A_s \cdot f_{uk}$ (or see Table C1)							
Partial factor			$\gamma_{Ms,N}$	[-]	see Table C1							
Combined pull-out and concrete failure												
Characteristic bond resistance in uncracked concrete C20/25												
Temperature range	I: 40°C/24°C	Dry, wet concrete	$\tau_{Rk,ucr}$	[N/mm²]	10	12	12	12	12	11	10	9
	II: 80°C/50°C				7,5	9	9	9	9	8,5	7,5	6,5
	III: 120°C/72°C				5,5	6,5	6,5	6,5	6,5	6,5	5,5	5,0
	I: 40°C/24°C	flooded bore hole			7,5	8,5	8,5	8,5	No Performance Assessed			
	II: 80°C/50°C				5,5	6,5	6,5	6,5				
	III: 120°C/72°C				4,0	5,0	5,0	5,0				
Characteristic bond resistance in cracked concrete C20/25												
Temperature range	I: 40°C/24°C	Dry, wet concrete	$\tau_{Rk,cr}$	[N/mm²]	4,0	5,0	5,5	5,5	5,5	5,5	6,5	6,5
	II: 80°C/50°C				2,5	3,5	4,0	4,0	4,0	4,0	4,5	4,5
	III: 120°C/72°C				2,0	2,5	3,0	3,0	3,0	3,0	3,5	3,5
	I: 40°C/24°C	flooded bore hole			4,0	4,0	5,5	5,5	No Performance Assessed			
	II: 80°C/50°C				2,5	3,0	4,0	4,0				
	III: 120°C/72°C				2,0	2,5	3,0	3,0				
Reduktion factor ψ^0_{sus} in cracked and uncracked concrete C20/25												
Temperature range	I: 40°C/24°C	Dry, wet concrete and flooded bore hole	ψ^0_{sus}	[-]	0,73							
	II: 80°C/50°C				0,65							
	III: 120°C/72°C				0,57							
Increasing factors for concrete ψ_c			C25/30		1,02							
			C30/37		1,04							
			C35/45		1,07							
			C40/50		1,08							
			C45/55		1,09							
			C50/60		1,10							
Concrete cone failure												
Relevant parameter					see Table C2							
Splitting												
Relevant parameter					see Table C2							
Installation factor												
for dry and wet concrete			γ_{inst}	[-]	1,0	1,2						
for flooded bore hole					1,4				No Performance Assessed			

RESINA VINILESTER + SIN ESTIRENO LUSAN for concrete	**Annex C 3**
Performances Characteristic values of tension loads under static and quasi-static action	

Table C4: Characteristic values of shear loads under static and quasi-static action

Anchor size threaded rod			M8	M10	M12	M16	M20	M24	M27	M30
Steel failure without lever arm										
Characteristic shear resistance Steel, strength class 4.6, 4.8, 5.6 and 5.8	$V^0_{Rk,s}$	[kN]	$0,6 \cdot A_s \cdot f_{uk}$ (or see Table C1)							
Characteristic shear resistance Steel, strength class 8.8 Stainless Steel A2, A4 and HCR, all classes	$V^0_{Rk,s}$	[kN]	$0,5 \cdot A_s \cdot f_{uk}$ (or see Table C1)							
Partial factor	$\gamma_{Ms,V}$	[-]	see Table C1							
Ductility factor	k_7	[-]	1,0							
Steel failure with lever arm										
Characteristic bending moment	$M^0_{Rk,s}$	[Nm]	$1,2 \cdot W_{el} \cdot f_{uk}$ (or see Table C1)							
Elastic section modulus	W_{el}	[mm³]	31	62	109	277	541	935	1387	1874
Partial factor	$\gamma_{Ms,V}$	[-]	see Table C1							
Concrete pry-out failure										
Factor	k_8	[-]	2,0							
Installation factor	γ_{inst}	[-]	1,0							
Concrete edge failure										
Effective length of fastener	l_f	[mm]	$\min(h_{ef};\ 12 \cdot d_{nom})$						$\min(h_{ef};\ 300mm)$	
Outside diameter of fastener	d_{nom}	[mm]	8	10	12	16	20	24	27	30
Installation factor	γ_{inst}	[-]	1,0							

Table C5: Characteristic values of tension loads under static and quasi-static action

Anchor size internal threaded anchor rods					HR-M6	HR-M8	HR-M10	HR-M12	HR-M16	HR-M20
Steel failure[1]										
Characteristic tension resistance, Steel, strength class		5.8	$N_{Rk,s}$	[kN]	10	17	29	42	76	123
		8.8	$N_{Rk,s}$	[kN]	16	27	46	67	121	196
Partial factor, strength class 5.8 and 8.8			$\gamma_{Ms,N}$	[-]	1,5					
Characteristic tension resistance, Stainless Steel A4 and HCR, Strength class 70 [2]			$N_{Rk,s}$	[kN]	14	26	41	59	110	124
Partial factor			$\gamma_{Ms,N}$	[-]	1,87					2,86
Combined pull-out and concrete cone failure										
Characteristic bond resistance in uncracked concrete C20/25										
Temperature range	I: 40°C/24°C	Dry, wet concrete	$\tau_{Rk,ucr}$	[N/mm²]	12	12	12	12	11	9
	II: 80°C/50°C	Dry, wet concrete	$\tau_{Rk,ucr}$	[N/mm²]	9	9	9	9	8,5	6,5
	III: 120°C/72°C	Dry, wet concrete	$\tau_{Rk,ucr}$	[N/mm²]	6,5	6,5	6,5	6,5	6,5	5,0
	I: 40°C/24°C	flooded bore hole	$\tau_{Rk,ucr}$	[N/mm²]	8,5	8,5	8,5	No Performance Assessed		
	II: 80°C/50°C	flooded bore hole	$\tau_{Rk,ucr}$	[N/mm²]	6,5	6,5	6,5	No Performance Assessed		
	III: 120°C/72°C	flooded bore hole	$\tau_{Rk,ucr}$	[N/mm²]	5,0	5,0	5,0	No Performance Assessed		
Characteristic bond resistance in cracked concrete C20/25										
Temperature range	I: 40°C/24°C	Dry, wet concrete	$\tau_{Rk,cr}$	[N/mm²]	5,0	5,5	5,5	5,5	5,5	6,5
	II: 80°C/50°C	Dry, wet concrete	$\tau_{Rk,cr}$	[N/mm²]	3,5	4,0	4,0	4,0	4,0	4,5
	III: 120°C/72°C	Dry, wet concrete	$\tau_{Rk,cr}$	[N/mm²]	2,5	3,0	3,0	3,0	3,0	3,5
	I: 40°C/24°C	flooded bore hole	$\tau_{Rk,cr}$	[N/mm²]	4,0	5,5	5,5	No Performance Assessed		
	II: 80°C/50°C	flooded bore hole	$\tau_{Rk,cr}$	[N/mm²]	3,0	4,0	4,0	No Performance Assessed		
	III: 120°C/72°C	flooded bore hole	$\tau_{Rk,cr}$	[N/mm²]	2,5	3,0	3,0	No Performance Assessed		
Reduktion factor ψ^0_{sus} in cracked and uncracked concrete C20/25										
Temperature range	I: 40°C/24°C	Dry, wet concrete and flooded bore hole	ψ^0_{sus}	[-]	0,73					
	II: 80°C/50°C	Dry, wet concrete and flooded bore hole	ψ^0_{sus}	[-]	0,65					
	III: 120°C/72°C	Dry, wet concrete and flooded bore hole	ψ^0_{sus}	[-]	0,57					
Increasing factors for concrete ψ_c			C25/30		1,02					
			C30/37		1,04					
			C35/45		1,07					
			C40/50		1,08					
			C45/55		1,09					
			C50/60		1,10					
Concrete cone failure										
Relevant parameter					see Table C2					
Splitting failure										
Relevant parameter					see Table C2					
Installation factor										
for dry and wet concrete			γ_{inst}	[-]	1,2					
for flooded bore hole			γ_{inst}	[-]	1,4			No Performance Assessed		

[1] Fastenings (incl. nut and washer) must comply with the appropriate material and property class of the internal threaded rod. The characteristic tension resistance for steel failure is valid for the internal threaded rod and the fastening element.
[2] For HR-M20 strength class 50 is valid

RESINA VINILESTER + SIN ESTIRENO LUSAN for concrete

Performances
Characteristic values of tension loads under static and quasi-static action

Annex C 5

Table C6: Characteristic values of shear loads under static and quasi-static action

Anchor size for internal threaded anchor rods				HR-M6	HR-M8	HR-M10	HR-M12	HR-M16	HR-M20
Steel failure without lever arm[1]									
Characteristic shear resistance, Steel, strength class	5.8	$V^0_{Rk,s}$	[kN]	5	9	15	21	38	61
	8.8	$V^0_{Rk,s}$	[kN]	8	14	23	34	60	98
Partial factor, strength class 5.8 and 8.8		$\gamma_{Ms,V}$	[-]	1,25					
Characteristic shear resistance, Stainless Steel A4 and HCR, Strength class 70[2]		$V^0_{Rk,s}$	[kN]	7	13	20	30	55	40
Partial factor		$\gamma_{Ms,V}$	[-]	1,56					2,38
Ductility factor		k_7	[-]	1,0					
Steel failure with lever arm[1]									
Characteristic bending moment, Steel, strength class	5.8	$M^0_{Rk,s}$	[Nm]	8	19	37	66	167	325
	8.8	$M^0_{Rk,s}$	[Nm]	12	30	60	105	267	519
Partial factor, strength class 5.8 and 8.8		$\gamma_{Ms,V}$	[-]	1,25					
Characteristic bending moment, Stainless Steel A4 and HCR, Strength class 70[2]		$M^0_{Rk,s}$	[Nm]	11	26	52	92	233	456
Partial factor		$\gamma_{Ms,V}$	[-]	1,56					2,38
Concrete pry-out failure									
Factor		k_8	[-]	2,0					
Installation factor		γ_{inst}	[-]	1,0					
Concrete edge failure									
Effective length of fastener		l_f	[mm]	$\min(h_{ef}; 12 \cdot d_{nom})$					$\min(h_{ef}; 300mm)$
Outside diameter of fastener		d_{nom}	[mm]	10	12	16	20	24	30
Installation factor		γ_{inst}	[-]	1,0					

[1] Fastenings (incl. nut and washer) must comply with the appropriate material and property class of the internal threaded rod. The characteristic tension resistance for steel failure is valid for the internal threaded rod and the fastening element.
[2] For HR-M20 strength class 50 is valid

Table C7: Characteristic values of tension loads under static and quasi-static action

Anchor size reinforcing bar				Ø 8	Ø 10	Ø 12	Ø 14	Ø 16	Ø 20	Ø 25	Ø 28	Ø 32
Steel failure												
Characteristic tension resistance		$N_{Rk,s}$	[kN]	$A_s \cdot f_{uk}$ [1]								
Cross section area		A_s	[mm²]	50	79	113	154	201	314	491	616	804
Partial factor		$\gamma_{Ms,N}$	[-]	1,4 [2]								
Combined pull-out and concrete failure												
Characteristic bond resistance in uncracked concrete C20/25												
Temperature range I: 40°C/24°C	Dry, wet concrete	$\tau_{Rk,ucr}$	[N/mm²]	10	12	12	12	12	12	11	10	8,5
Temperature range II: 80°C/50°C	Dry, wet concrete	$\tau_{Rk,ucr}$	[N/mm²]	7,5	9	9	9	9	9	8,0	7,0	6,0
Temperature range III: 120°C/72°C	Dry, wet concrete	$\tau_{Rk,ucr}$	[N/mm²]	5,5	6,5	6,5	6,5	6,5	6,5	6,0	5,0	4,5
Temperature range I: 40°C/24°C	flooded bore hole	$\tau_{Rk,ucr}$	[N/mm²]	7,5	8,5	8,5	8,5	8,5	No Performance Assessed			
Temperature range II: 80°C/50°C	flooded bore hole	$\tau_{Rk,ucr}$	[N/mm²]	5,5	6,5	6,5	6,5	6,5				
Temperature range III: 120°C/72°C	flooded bore hole	$\tau_{Rk,ucr}$	[N/mm²]	4,0	5,0	5,0	5,0	5,0				
Characteristic bond resistance in cracked concrete C20/25												
Temperature range I: 40°C/24°C	Dry, wet concrete	$\tau_{Rk,cr}$	[N/mm²]	4,0	5,0	5,5	5,5	5,5	5,5	5,5	6,5	6,5
Temperature range II: 80°C/50°C	Dry, wet concrete	$\tau_{Rk,cr}$	[N/mm²]	2,5	3,5	4,0	4,0	4,0	4,0	4,0	4,5	4,5
Temperature range III: 120°C/72°C	Dry, wet concrete	$\tau_{Rk,cr}$	[N/mm²]	2,0	2,5	3,0	3,0	3,0	3,0	3,0	3,5	3,5
Temperature range I: 40°C/24°C	flooded bore hole	$\tau_{Rk,cr}$	[N/mm²]	4,0	4,0	5,5	5,5	5,5	No Performance Assessed			
Temperature range II: 80°C/50°C	flooded bore hole	$\tau_{Rk,cr}$	[N/mm²]	2,5	3,0	4,0	4,0	4,0				
Temperature range III: 120°C/72°C	flooded bore hole	$\tau_{Rk,cr}$	[N/mm²]	2,0	2,5	3,0	3,0	3,0				
Reduktion factor ψ^0_{sus} in cracked and uncracked concrete C20/25												
Temperature range I: 40°C/24°C	Dry, wet concrete and flooded bore hole	ψ^0_{sus}	[-]	0,73								
Temperature range II: 80°C/50°C	Dry, wet concrete and flooded bore hole	ψ^0_{sus}	[-]	0,65								
Temperature range III: 120°C/72°C	Dry, wet concrete and flooded bore hole	ψ^0_{sus}	[-]	0,57								
Increasing factors for concrete ψ_c		C25/30		1,02								
		C30/37		1,04								
		C35/45		1,07								
		C40/50		1,08								
		C45/55		1,09								
		C50/60		1,10								
Concrete cone failure												
Relevant parameter				see Table C2								
Splitting												
Relevant parameter				see Table C2								
Installation factor												
for dry and wet concrete		γ_{inst}	[-]	1,2	1,2							
for flooded bore hole		γ_{inst}	[-]	1,4					No Performance Assessed			

[1] f_{uk} shall be taken from the specifications of reinforcing bars
[2] in absence of national regulation

RESINA VINILESTER + SIN ESTIRENO LUSAN for concrete	**Annex C 7**
Performances Characteristic values of tension loads under static and quasi-static action	

Table C8: Characteristic values of shear loads under static and quasi-static action

Anchor size reinforcing bar			Ø 8	Ø 10	Ø 12	Ø 14	Ø 16	Ø 20	Ø 25	Ø 28	Ø 32
Steel failure without lever arm											
Characteristic shear resistance	$V^0_{Rk,s}$	[kN]	$0{,}50 \cdot A_s \cdot f_{uk}$ [1)]								
Cross section area	A_s	[mm²]	50	79	113	154	201	314	491	616	804
Partial factor	$\gamma_{Ms,V}$	[-]	1,5[2)]								
Ductility factor	k_7	[-]	1,0								
Steel failure with lever arm											
Characteristic bending moment	$M^0_{Rk,s}$	[Nm]	$1.2 \cdot W_{el} \cdot f_{uk}$ [1)]								
Elastic section modulus	W_{el}	[mm³]	50	98	170	269	402	785	1534	2155	3217
Partial factor	$\gamma_{Ms,V}$	[-]	1,5[2)]								
Concrete pry-out failure											
Factor	k_8	[-]	2,0								
Installation factor	γ_{inst}	[-]	1,0								
Concrete edge failure											
Effective length of fastener	l_f	[mm]	$\min(h_{ef};\ 12 \cdot d_{nom})$						$\min(h_{ef};\ 300\text{mm})$		
Outside diameter of fastener	d_{nom}	[mm]	8	10	12	14	16	20	25	28	32
Installation factor	γ_{inst}	[-]	1,0								

[1)] f_{uk} shall be taken from the specifications of reinforcing bars
[2)] in absence of national regulation

RESINA VINILESTER + SIN ESTIRENO LUSAN for concrete	**Annex C 8**
Performances Characteristic values of shear loads under static and quasi-static action	

Table C9: Displacements under tension load[1) (threaded rod)

Anchor size threaded rod			M8	M10	M12	M16	M20	M24	M27	M30
Uncracked concrete C20/25 under static and quasi-static action										
Temperature range I: 40°C/24°C	δ_{N0}-factor	[mm/(N/mm²)]	0,021	0,023	0,026	0,031	0,036	0,041	0,045	0,049
	$\delta_{N\infty}$-factor	[mm/(N/mm²)]	0,030	0,033	0,037	0,045	0,052	0,060	0,065	0,071
Temperature range II: 80°C/50°C	δ_{N0}-factor	[mm/(N/mm²)]	0,050	0,056	0,063	0,075	0,088	0,100	0,110	0,119
	$\delta_{N\infty}$-factor	[mm/(N/mm²)]	0,072	0,081	0,090	0,108	0,127	0,145	0,159	0,172
Temperature range III: 120°C/72°C	δ_{N0}-factor	[mm/(N/mm²)]	0,050	0,056	0,063	0,075	0,088	0,100	0,110	0,119
	$\delta_{N\infty}$-factor	[mm/(N/mm²)]	0,072	0,081	0,090	0,108	0,127	0,145	0,159	0,172
Cracked concrete C20/25 under static and quasi-static action										
Temperature range I: 40°C/24°C	δ_{N0}-factor	[mm/(N/mm²)]	0,090		0,070					
	$\delta_{N\infty}$-factor	[mm/(N/mm²)]	0,105		0,105					
Temperature range II: 80°C/50°C	δ_{N0}-factor	[mm/(N/mm²)]	0,219		0,170					
	$\delta_{N\infty}$-factor	[mm/(N/mm²)]	0,255		0,245					
Temperature range III: 120°C/72°C	δ_{N0}-factor	[mm/(N/mm²)]	0,219		0,170					
	$\delta_{N\infty}$-factor	[mm/(N/mm²)]	0,255		0,245					

[1) Calculation of the displacement
$\delta_{N0} = \delta_{N0}\text{-factor} \cdot \tau$; τ: action bond stress for tension
$\delta_{N\infty} = \delta_{N\infty}\text{-factor} \cdot \tau$;

Table C10: Displacements under shear load[1) (threaded rod)

Anchor size threaded rod			M8	M10	M12	M16	M20	M24	M27	M30
Uncracked concrete C20/25 under static and quasi-static action										
All temperature ranges	δ_{V0}-factor	[mm/kN]	0,06	0,06	0,05	0,04	0,04	0,03	0,03	0,03
	$\delta_{V\infty}$-factor	[mm/kN]	0,09	0,08	0,08	0,06	0,06	0,05	0,05	0,05
Cracked concrete C20/25 under static and quasi-static action										
All temperature ranges	δ_{V0}-factor	[mm/kN]	0,12	0,12	0,11	0,10	0,09	0,08	0,08	0,07
	$\delta_{V\infty}$-factor	[mm/kN]	0,18	0,18	0,17	0,15	0,14	0,13	0,12	0,10

[1) Calculation of the displacement
$\delta_{V0} = \delta_{V0}\text{-factor} \cdot V$; V: action shear load
$\delta_{V\infty} = \delta_{V\infty}\text{-factor} \cdot V$;

RESINA VINILESTER + SIN ESTIRENO LUSAN for concrete	**Annex C 9**
Performances Displacements (threaded rods)	

Table C11: Displacements under tension load[1] (Internal threaded anchor rod)

Anchor size Internal threaded anchor rod			HR-M6	HR-M8	HR-M10	HR-M12	HR-M16	HR-M20
Uncracked concrete C20/25 under static and quasi-static action								
Temperature range I: 40°C/24°C	δ_{N0}-factor	[mm/(N/mm²)]	0,023	0,026	0,031	0,036	0,041	0,049
	$\delta_{N\infty}$-factor	[mm/(N/mm²)]	0,033	0,037	0,045	0,052	0,060	0,071
Temperature range II: 80°C/50°C	δ_{N0}-factor	[mm/(N/mm²)]	0,056	0,063	0,075	0,088	0,100	0,119
	$\delta_{N\infty}$-factor	[mm/(N/mm²)]	0,081	0,090	0,108	0,127	0,145	0,172
Temperature range III: 120°C/72°C	δ_{N0}-factor	[mm/(N/mm²)]	0,056	0,063	0,075	0,088	0,100	0,119
	$\delta_{N\infty}$-factor	[mm/(N/mm²)]	0,081	0,090	0,108	0,127	0,145	0,172
Cracked concrete C20/25 under static and quasi-static action								
Temperature range I: 40°C/24°C	δ_{N0}-factor	[mm/(N/mm²)]	0,090	0,070				
	$\delta_{N\infty}$-factor	[mm/(N/mm²)]	0,105	0,105				
Temperature range II: 80°C/50°C	δ_{N0}-factor	[mm/(N/mm²)]	0,219	0,170				
	$\delta_{N\infty}$-factor	[mm/(N/mm²)]	0,255	0,245				
Temperature range III: 120°C/72°C	δ_{N0}-factor	[mm/(N/mm²)]	0,219	0,170				
	$\delta_{N\infty}$-factor	[mm/(N/mm²)]	0,255	0,245				

[1] Calculation of the displacement
$\delta_{N0} = \delta_{N0}\text{-factor} \cdot \tau$; τ: action bond stress for tension
$\delta_{N\infty} = \delta_{N\infty}\text{-factor} \cdot \tau$;

Table C12: Displacements under shear load[1] (Internal threaded anchor rod)

Anchor size Internal threaded anchor rod			HR-M6	HR-M8	HR-M10	HR-M12	HR-M16	HR-M20
Uncracked and cracked concrete C20/25 under static and quasi-static action								
All temperature ranges	δ_{V0}-factor	[mm/kN]	0,07	0,06	0,06	0,05	0,04	0,04
	$\delta_{V\infty}$-factor	[mm/kN]	0,10	0,09	0,08	0,08	0,06	0,06

[1] Calculation of the displacement
$\delta_{V0} = \delta_{V0}\text{-factor} \cdot V$; V: action shear load
$\delta_{V\infty} = \delta_{V\infty}\text{-factor} \cdot V$;

Table C13: Displacements under tension load[1] (rebar)

Anchor size reinforcing bar			Ø 8	Ø 10	Ø 12	Ø 14	Ø 16	Ø 20	Ø 25	Ø 28	Ø 32
Uncracked concrete C20/25 under static and quasi-static action											
Temperature range I: 40°C/24°C	δ_{N0}-factor	[mm/(N/mm²)]	0,021	0,023	0,026	0,028	0,031	0,036	0,043	0,047	0,052
	$\delta_{N\infty}$-factor	[mm/(N/mm²)]	0,030	0,033	0,037	0,041	0,045	0,052	0,061	0,071	0,075
Temperature range II: 80°C/50°C	δ_{N0}-factor	[mm/(N/mm²)]	0,050	0,056	0,063	0,069	0,075	0,088	0,104	0,113	0,126
	$\delta_{N\infty}$-factor	[mm/(N/mm²)]	0,072	0,081	0,090	0,099	0,108	0,127	0,149	0,163	0,181
Temperature range III: 120°C/72°C	δ_{N0}-factor	[mm/(N/mm²)]	0,050	0,056	0,063	0,069	0,075	0,088	0,104	0,113	0,126
	$\delta_{N\infty}$-factor	[mm/(N/mm²)]	0,072	0,081	0,090	0,099	0,108	0,127	0,149	0,163	0,181
Cracked concrete C20/25 under static and quasi-static action											
Temperature range I: 40°C/24°C	δ_{N0}-factor	[mm/(N/mm²)]		0,090				0,070			
	$\delta_{N\infty}$-factor	[mm/(N/mm²)]		0,105				0,105			
Temperature range II: 80°C/50°C	δ_{N0}-factor	[mm/(N/mm²)]		0,219				0,170			
	$\delta_{N\infty}$-factor	[mm/(N/mm²)]		0,255				0,245			
Temperature range III: 120°C/72°C	δ_{N0}-factor	[mm/(N/mm²)]		0,219				0,170			
	$\delta_{N\infty}$-factor	[mm/(N/mm²)]		0,255				0,245			

[1] Calculation of the displacement
$\delta_{N0} = \delta_{N0}\text{-factor} \cdot \tau$; τ: action bond stress for tension
$\delta_{N\infty} = \delta_{N\infty}\text{-factor} \cdot \tau$;

Table C14: Displacement under shear load[1] (rebar)

Anchor size reinforcing bar			Ø 8	Ø 10	Ø 12	Ø 14	Ø 16	Ø 20	Ø 25	Ø 28	Ø 32
Uncracked concrete C20/25 under static and quasi-static action											
All temperature ranges	δ_{V0}-factor	[mm/kN]	0,06	0,05	0,05	0,04	0,04	0,04	0,03	0,03	0,03
	$\delta_{V\infty}$-factor	[mm/kN]	0,09	0,08	0,08	0,06	0,06	0,05	0,05	0,04	0,04
Cracked concrete C20/25 under static and quasi-static action											
All temperature ranges	δ_{V0}-factor	[mm/kN]	0,12	0,12	0,11	0,11	0,10	0,09	0,08	0,07	0,06
	$\delta_{V\infty}$-factor	[mm/kN]	0,18	0,18	0,17	0,16	0,15	0,14	0,12	0,11	0,10

[1] Calculation of the displacement
$\delta_{V0} = \delta_{V0}\text{-factor} \cdot V$; V: action shear load
$\delta_{V\infty} = \delta_{V\infty}\text{-factor} \cdot V$;

Table C15: Characteristic values of tension loads under seismic action (performance category C1)

Anchor size threaded rod					M8	M10	M12	M16	M20	M24	M27	M30
Steel failure												
Characteristic tension resistance			$N_{Rk,s,eq,C1}$	[kN]	$1{,}0 \cdot N_{Rk,s}$							
Partial factor			$\gamma_{Ms,N}$	[-]	see Table C1							
Combined pull-out and concrete failure												
Characteristic bond resistance in uncracked and cracked concrete C20/25												
Temperature range	I: 40°C/24°C	Dry, wet concrete	$\tau_{Rk,eq,C1}$	[N/mm²]	2,5	3,1	3,7	3,7	3,7	3,8	4,5	4,5
	II: 80°C/50°C				1,6	2,2	2,7	2,7	2,7	2,8	3,1	3,1
	III: 120°C/72°C				1,3	1,6	2,0	2,0	2,0	2,1	2,4	2,4
	I: 40°C/24°C	flooded bore hole			2,5	2,5	3,7	3,7	No Performance Assessed			
	II: 80°C/50°C				1,6	1,9	2,7	2,7				
	III: 120°C/72°C				1,3	1,6	2,0	2,0				
Increasing factors for concrete ψ_C			C25/30 to C50/60		1,0							
Installation factor												
for dry and wet concrete			γ_{inst}	[-]	1,0	1,2						
for flooded bore hole					1,4				No Performance Assessed			

Table C16: Characteristic values of shear loads under seismic action (performance category C1)

Anchor size threaded rod			M8	M10	M12	M16	M20	M24	M27	M30
Steel failure without lever arm										
Characteristic shear resistance (Seismic C1)	$V_{Rk,s,eq,C1}$	[kN]	$0{,}70 \cdot V^0_{Rk,s}$							
Partial factor	$\gamma_{Ms,V}$	[-]	see Table C1							
Factor for annular gap	α_{gap}	[-]	0,5 (1,0)[1)]							

1) Value in brackets valid for filled annular gab between anchor and clearance hole in the fixture. Use of special filling washer Annex A 3 is required

Table C17: Characteristic values of tension loads under seismic action (performance category C1)

Anchor size reinforcing bar				Ø 8	Ø 10	Ø 12	Ø 14	Ø 16	Ø 20	Ø 25	Ø 28	Ø 32
Steel failure												
Characteristic tension resistance		$N_{Rk,s,eq,C1}$	[kN]	$1{,}0 \cdot A_s \cdot f_{uk}$[1)]								
Cross section area		A_s	[mm²]	50	79	113	154	201	314	491	616	804
Partial factor		$\gamma_{Ms,N}$	[-]	1,4[2)]								
Combined pull-out and concrete failure												
Characteristic bond resistance in uncracked and cracked concrete C20/25												
Temperature range I: 40°C/24°C	Dry, wet concrete	$\tau_{Rk,eq,C1}$	[N/mm²]	2,5	3,1	3,7	3,7	3,7	3,7	3,8	4,5	4,5
Temperature range II: 80°C/50°C	Dry, wet concrete	$\tau_{Rk,eq,C1}$	[N/mm²]	1,6	2,2	2,7	2,7	2,7	2,7	2,8	3,1	3,1
Temperature range III: 120°C/72°C	Dry, wet concrete	$\tau_{Rk,eq,C1}$	[N/mm²]	1,3	1,6	2,0	2,0	2,0	2,0	2,1	2,4	2,4
Temperature range I: 40°C/24°C	flooded bore hole	$\tau_{Rk,eq,C1}$	[N/mm²]	2,5	2,5	3,7	3,7	3,7	No Performance Assessed			
Temperature range II: 80°C/50°C	flooded bore hole	$\tau_{Rk,eq,C1}$	[N/mm²]	1,6	1,9	2,7	2,7	2,7				
Temperature range III: 120°C/72°C	flooded bore hole	$\tau_{Rk,eq,C1}$	[N/mm²]	1,3	1,6	2,0	2,0	2,0				
Increasing factors for concrete ψ_c		C25/30 to C50/60		1,0								
Installation factor												
for dry and wet concrete		γ_{inst}	[-]	1,2	1,2							
for flooded bore hole		γ_{inst}	[-]	1,4					No Performance Assessed			

1) f_{uk} shall be taken from the specifications of reinforcing bars
2) in absence of national regulation

Table C18: Characteristic values of shear loads under seismic action (performance category C1)

Anchor size reinforcing bar			Ø 8	Ø 10	Ø 12	Ø 14	Ø 16	Ø 20	Ø 25	Ø 28	Ø 32
Steel failure without lever arm											
Characteristic shear resistance	$V_{Rk,s,eq,C1}$	[kN]	$0{,}35 \cdot A_s \cdot f_{uk}$[2)]								
Cross section area	A_s	[mm²]	50	79	113	154	201	314	491	616	804
Partial factor	$\gamma_{Ms,V}$	[-]	1,5[2)]								
Factor for annular gap	α_{gap}	[-]	0,5 (1,0)[3)]								

1) f_{uk} shall be taken from the specifications of reinforcing bars
2) in absence of national regulation
3) Value in brackets valid for filled annular gab between anchor and clearance hole in the fixture. Use of special filling washer Annex A 3 is required

RESINA VINILESTER + SIN ESTIRENO LUSAN for concrete	**Annex C 13**
Performances Characteristic values of tension loads and shear loads under seismic action (performance category C1)	

Deutsches Institut für Bautechnik
DIBt

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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-21/0266 of 31 May 2021

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	RESINA VINILESTER + SIN ESTIRENO LUSAN
Product family to which the construction product belongs	Metal Injection anchors for use in masonry
Manufacturer	LUSAN FIJACIONES Y ANCLAJES, S.L. C. / Molinos 20 29491 ALGATOCIN, MALAGA SPANIEN
Manufacturing plant	PLANT 1
This European Technical Assessment contains	58 pages including 3 annexes which form an integral part of this assessment
This European Technical Assessment is issued in accordance with Regulation (EU) No 305/2011, on the basis of	EAD 330076-00-0604, Edition 11/2017

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 "RESINA VINILESTER + SIN ESTIRENO LUSAN" is a bonded anchor (injection type) consisting of a mortar cartridge with injection mortar VINI or VININ, a perforated sleeve and an anchor rod with hexagon nut and washer or an Internal threaded rod. The steel elements are made of zinc coated steel, stainless steel or high corrosion resistant steel.

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

The product description is given in Annex A.

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

The performances given in Section 3 are only valid if the 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 values for resistance	See Annexes C 1 to C 40
Displacements	See Annexes C 6 to C 40
Durability	See annex B 1

3.2 Safety in case of fire (BWR 2)

Essential characteristic	Performance
Reaction to fire	Class A1

3.3 Hygiene, health and the environment (BWR 3)

Essential characteristic	Performance
Content, emission and/or release of dangerous substances	No performance assessed

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

In accordance with the European Assessment Document EAD 330076-00-0604 the applicable European legal act is: [97/177/EC].

The system to be applied is: 1

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

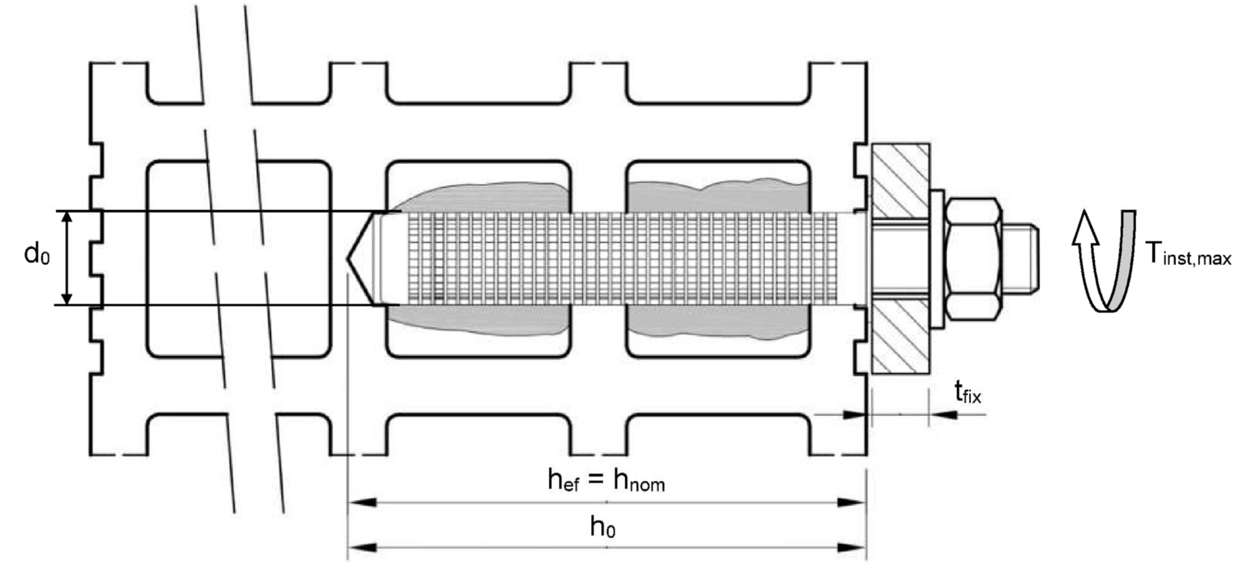
Technical details necessary for the implementation of the AVCP system are laid down in the control plan deposited at Deutsches Institut für Bautechnik.

Issued in Berlin on 31 May 2021 by Deutsches Institut für Bautechnik

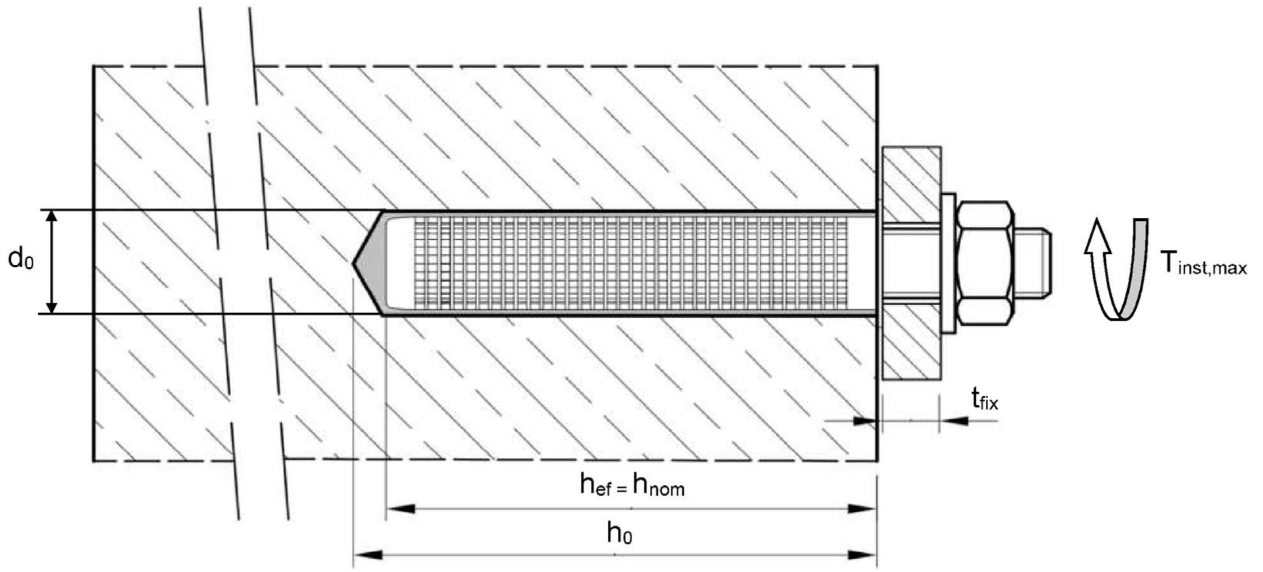
Dipl.-Ing. Beatrix Wittstock
Head of Section

beglaubigt:
Baderschneider

Installation in hollow brick; threaded rod and Internal threaded rod with sleeve



Installation in solid brick; threaded rod and Internal threaded rod with or without sleeve

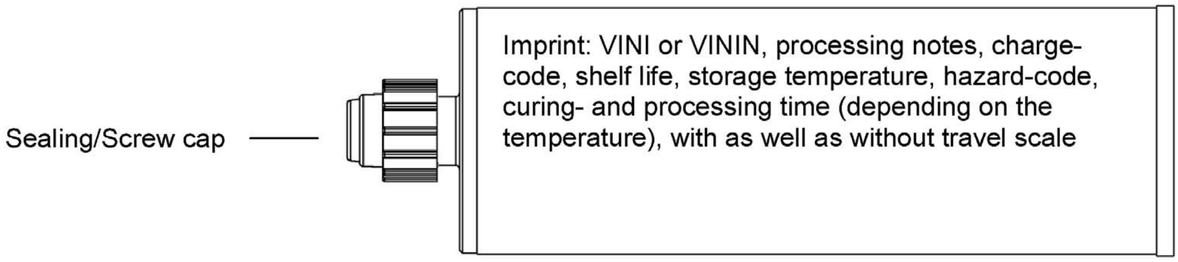


$h_{ef} = h_{nom}$	=	effective anchorage depth	d_0	=	nominal drill hole diameter
h_0	=	drill hole depth	$T_{inst,max}$	=	Max installation torque moment
t_{fix}	=	thickness of fixture			

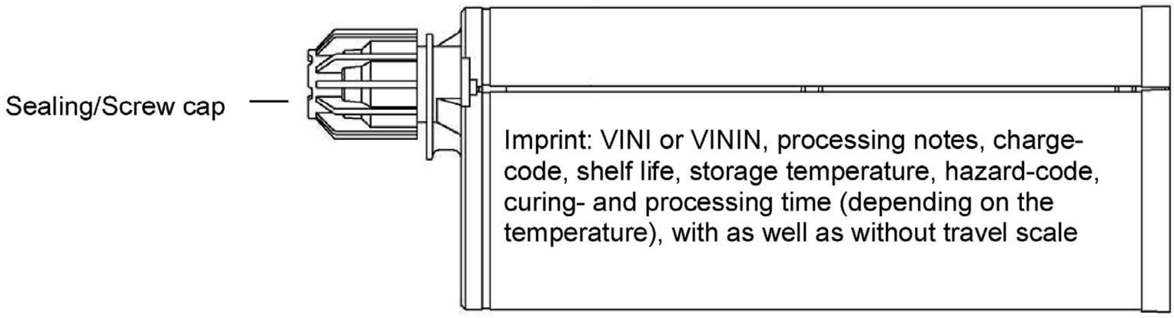
RESINA VINILESTER + SIN ESTIRENO LUSAN	**Annex A 1**
Product description Installed condition	

Cartridge: VINI or VININ

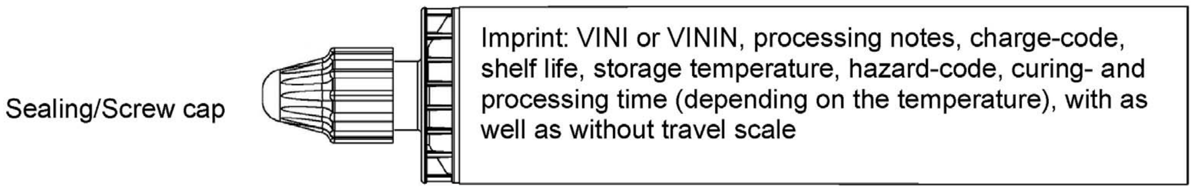
150 ml, 280 ml, 300 ml up to 333 ml and 380 ml up to 420 ml Cartridge: (Type: coaxial)



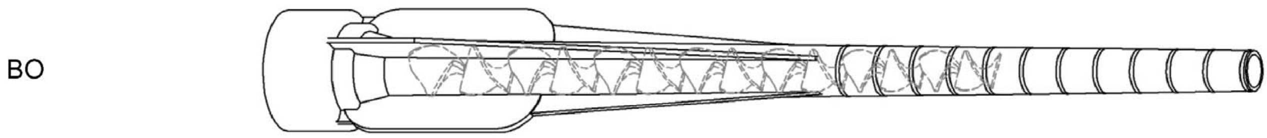
235 ml, 345 ml up to 360 ml and 825 ml Cartridge (Type: “side-by-side”)



165 ml and 300 ml Cartridge (Type: “foil tube”)

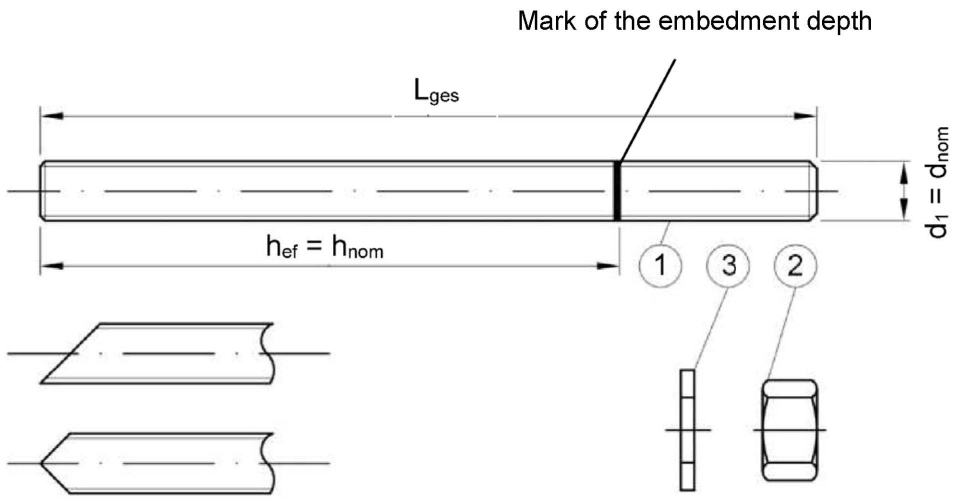


Static mixer



RESINA VINILESTER + SIN ESTIRENO LUSAN	**Annex A 2**
Product description Injection system	

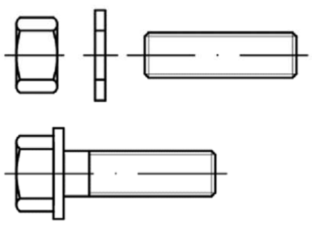
Threaded Rod M8, M10, M12, M16

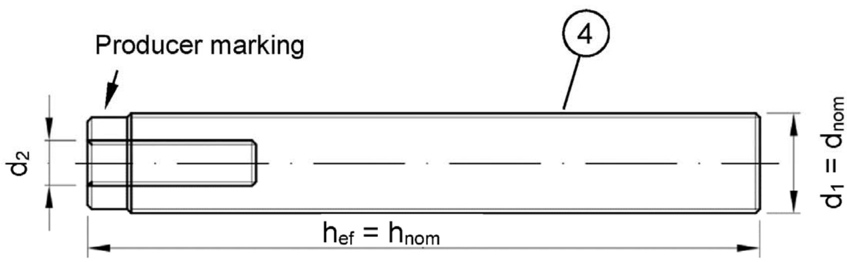


Commercial standard rod with:
- Materials, dimensions and mechanical properties acc. to Table A1
- Inspection certificate 3.1 acc. to EN 10204:2004. The document shall be stored.
- Marking of embedment depth

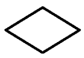
Internal threaded rod HR-M6, HR-M8, HR-M10

Threaded rod or screw





Producer marking: e.g. 

I	Marking Internal thread
	Mark
M8	Thread size (Internal thread)
A4	additional mark for stainless steel
HCR	additional mark for high-corrosion resistance steel

RESINA VINILESTER + SIN ESTIRENO LUSAN	**Annex A 3**
Product description Anchor rods	

Table A1: Materials

Part	Designation	Material			
Steel, zinc plated (Steel acc. to EN ISO 683-4:2018 or EN 10263:2001) - zinc plated ≥ 5 µm acc. to EN ISO 4042:2018 or - hot-dip galvanised ≥ 40 µm acc. to EN ISO 1461:2009 and EN ISO 10684:2004+AC:2009 or - sherardized ≥ 45 µm acc. to EN ISO 17668:2016					
1	Threaded rod	Property class		Characteristic steel ultimate tensile strength	Characteristic steel yield strength
		acc. to EN ISO 898-1:2013	4.6	f_{uk} = 400 N/mm²	f_{yk} = 240 N/mm²
			4.8	f_{uk} = 400 N/mm²	f_{yk} = 320 N/mm²
			5.6	f_{uk} = 500 N/mm²	f_{yk} = 300 N/mm²
			5.8	f_{uk} = 500 N/mm²	f_{yk} = 400 N/mm²
			8.8	f_{uk} = 800 N/mm²	f_{yk} = 640 N/mm²
2	Hexagon nut	acc. to EN ISO 898-2:2012	4	for anchor rod class 4.6 or 4.8	
			5	for anchor rod class 5.6 or 5.8	
			8	for anchor rod class 8.8	
3	Washer	Steel, zinc plated, hot-dip galvanised or sherardized (e.g.: EN ISO 887:2006, EN ISO 7089:2000, EN ISO 7093:2000 or EN ISO 7094:2000)			
4	Internal threaded anchor rod	Property class		Characteristic steel ultimate tensile strength	Characteristic steel yield strength
		acc. to EN ISO 898-1:2013	5.8	f_{uk} = 500 N/mm²	f_{yk} = 400 N/mm²
			8.8	f_{uk} = 800 N/mm²	f_{yk} = 640 N/mm²
Stainless steel A2 (Material 1.4301 / 1.4307 / 1.4311 / 1.4567 or 1.4541, acc. to EN 10088-1:2014) **Stainless steel A4** (Material 1.4401 / 1.4404 / 1.4571 / 1.4362 or 1.4578, acc. to EN 10088-1:2014) **High corrosion resistance steel** (Material 1.4529 or 1.4565, acc. to EN 10088-1: 2014)					
1	Threaded rod [1)]	Property class		Characteristic steel ultimate tensile strength	Characteristic steel yield strength
		acc. to EN ISO 3506-1:2020	50	f_{uk} = 500 N/mm²	f_{yk} = 210 N/mm²
			70	f_{uk} = 700 N/mm²	f_{yk} = 450 N/mm²
			80	f_{uk} = 800 N/mm²	f_{yk} = 600 N/mm²
2	Hexagon nut [1)]	acc. to EN ISO 3506-1:2020	50	for anchor rod class 50	
			70	for anchor rod class 70	
			80	for anchor rod class 80	
3	Washer	A2: Material 1.4301 / 1.4307 / 1.4311 / 1.4567 or 1.4541, acc. to EN 10088-1:2014 A4: Material 1.4401 / 1.4404 / 1.4571 / 1.4362 or 1.4578, acc. to EN 10088-1:2014 HCR: Material 1.4529 or 1.4565, acc. to EN 10088-1: 2014 (e.g.: EN ISO 887:2006, EN ISO 7089:2000, EN ISO 7093:2000 or EN ISO 7094:2000)			
4	Internal threaded anchor rod [1)]	Property class		Characteristic steel ultimate tensile strength	Characteristic steel yield strength
		acc. to EN ISO 3506-1:2020	50	f_{uk} = 500 N/mm²	f_{yk} = 210 N/mm²
			70	f_{uk} = 700 N/mm²	f_{yk} = 450 N/mm²
[1)] Property class 80 only for stainless steel A4 and HCR					
Plastic sleeve					
Perforated sleeve				Polypropylene (PP)	

RESINA VINILESTER + SIN ESTIRENO LUSAN

Product description
Materials

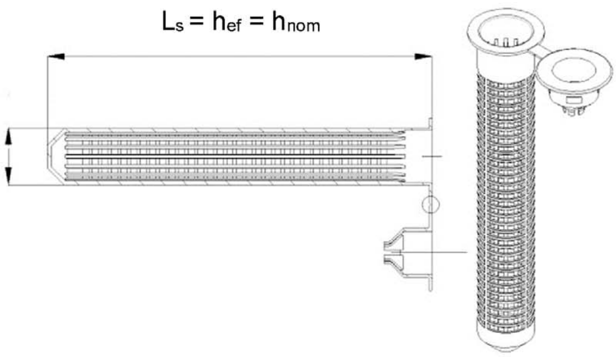
Annex A 4

Deutsches Institut für Bautechnik DIBt

Table A2: perforated sleeve

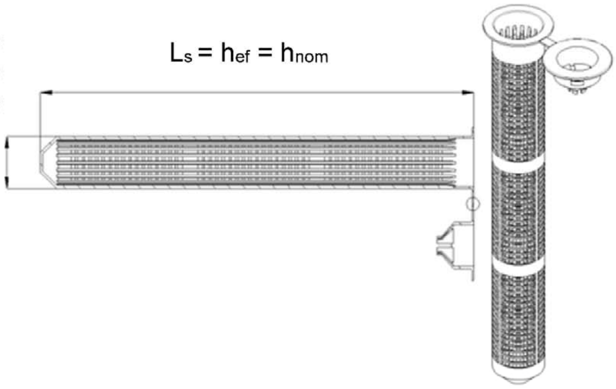
SH 12x80
SH 16x85
SH 20x85

$L_s = h_{ef} = h_{nom}$



SH 16x130
SH 20x130
SH 20x200

$L_s = h_{ef} = h_{nom}$



SH 16x130 / 330

for installation through insulation up to a thickness of 20 cm or push through installation

Table A3: sleeve dimensions

sleeve			
size	d_s	L_s	$h_{ef} = h_{nom}$
[mm]	[mm]	[mm]	[mm]
SH 12x80	12	80	80
SH 16x85	16	85	85
SH 16x130	16	130	130
SH 16x130 / 330 [1)]	16	330	130
SH 20x85	20	85	85
SH 20x130	20	130	130
SH 20x200	20	200	200

1) In annex C4 – C40 this sleeve is covered with the SH 16x130

Table A4: Steel parts

Anchor Rod			
Size	$d_1 = d_{nom}$	d_2	l_{ges}
[mm]	[mm]	[mm]	[mm]
HR-M6 [1)]	10	6	with sleeve: hef - 5mm without sleeve: hef
HR-M8 [1)]	12	8	
HR-M10 [1)]	16	10	
M8	8	-	hef + t_{fix} + 9,5
M10	10	-	hef + t_{fix} + 11,5
M12	12	-	hef + t_{fix} + 17,5
M16	16	-	hef + t_{fix} + 20,0

1) Internal threaded rod with metric external thread

RESINA VINILESTER + SIN ESTIRENO LUSAN

Product description
Sleeves

Annex A 5

Specifications of intended use

Anchorages subject to:
- Static and quasi-static loads

Base materials:
- Autoclaved Aerated Concrete (Use condition d) according to Annex B2
- Solid brick masonry (Use condition b), according to Annex B2.
- Hollow brick masonry (Use condition c), according to Annex B2 and B3
- Mortar strength class of the masonry M2,5 at minimum according to EN 998-2:2010.
- For other bricks in solid masonry and in hollow masonry or in autoclaved aerated concrete, the characteristic resistance of the anchor may be determined by job site tests according to EOTA TR 053, Edition April 2016 under consideration of the β-factor according to Annex C1, Table C1.

Temperature Range:
- T_a: - 40°C to +40°C (max. short term temperature +40°C and max. long term temperature +24°C)
- T_b: - 40°C to +80°C (max. short term temperature +80°C and max. long term temperature +50°C)
- T_c: - 40°C to +120°C (max. short term temperature +120°C and max. long term temperature +72°C)

Use conditions (Environmental conditions):
- Dry and wet structure (regarding injection mortar).
- Structures subject to dry internal conditions (zinc coated steel, stainless steel or high corrosion resistant steel).
- Structures subject to external atmospheric exposure (including industrial and marine environment) and 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).

Use conditions in respect of installation and use:
- Condition d/d: Installation and use in dry masonry
- Condition w/w: Installation and use in dry or wet masonry (incl. w/d installation in wet masonry and use in dry masonry)

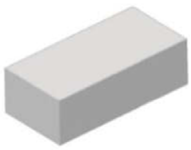
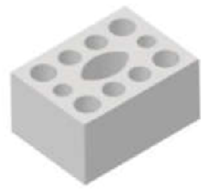
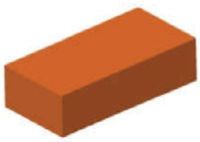
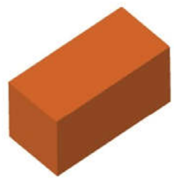
Design:
- Verifiable calculation notes and drawings are prepared taking account the relevant masonry in the region of the anchorage, the loads to be transwithted and their transmission to the supports of the structure. The position of the anchor is indicated on the design drawings.
- The anchorages are designed in accordance with the EOTA TR 054, Edition April 2016, Design method A under the responsibility of an engineer experienced in anchorages and masonry work.
- $N_{Rk,p} = N_{Rk,b}$ see Annex C4 to C40; $N_{Rk,s}$ see Annex C2; $N_{Rk,pb}$ see EOTA TR 054, Edition April 2016
- $V_{Rk,b}$ see Annex C4 to C40; $V_{Rk,s}$ see Annex C2; $V_{Rk,c}$ see Annex C3; $V_{Rk,pb}$ see EOTA TR 054, Edition April 2016
- For application with sleeve with drill bit size ≤ 15mm installd in joints not filled with mortar:
  - $N_{Rk,p,j} = 0,18 * N_{Rk,p}$ and $N_{Rk,b,j} = 0,18 * N_{Rk,b}$ ($N_{Rk,p} = N_{Rk,b}$ see Annex C4 to C40)
  - $V_{Rk,c,j} = 0,15 * V_{Rk,c}$ and $V_{Rk,b,j} = 0,15 * V_{Rk,b}$ ($V_{Rk,b}$ see Annex C4 to C40; and $V_{Rk,c}$ see Annex C3)
- Application without sleeve installd in joints not filled with mortar is not allowed.

Installation:
- Dry or wet structures.
- 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 (incl. nut and washer) must comply with the appropriate material and property class of the Internal threaded rod .

RESINA VINILESTER + SIN ESTIRENO LUSAN	**Annex B 1**
Intended use Specifications	

Deutsches Institut für Bautechnik DIBt

Table B1: Overview brick types and properties with corresponding fastening elements (Anchor and Sleeves)

naming density [kg/dm³] dimensions LxBxH [mm]	picture	anchor rods	perforated sleeve	Annex	naming density [kg/dm³] dimensions LxBxH [mm]	picture	anchor rods	perforated sleeve	Annex
Autoclaved aerated concrete acc. to EN 771-4					**solid light weight concrete brick acc. to EN 771-3**				
AAC ρ = 0,35-0,60 ≥ 499x240x249		M8 – M16 HR-M6 - HR-M10	12x80 16x85 16x130 20x85 20x130 20x200	C4 – C6	VBL ρ ≥ 0,6 ≥240x300x113		M8 - M16 HR-M6 - HR-M10	12x80 16x85 16x130 20x85 20x130 20x200	C39 - C40
Hollow light weight concrete brick acc. to EN 771-3									
HBL 16DF ρ ≥ 1,0 500x250x240		M8 - M16 HR-M6 - HR-M10	16x85 16x130 20x85 20x130 20x200	C35 - C36	Bloc creux B40 ρ ≥ 0,8 495x195x190		M8 - M16 HR-M6 - HR-M10	16x130 20x130	C37 - C38
Calcium silica bricks acc. to EN 771-2									
KS ρ ≥ 2,0 ≥ 240x115x71		M8 – M16 HR-M6 - HR-M10	12x80 16x85 16x130 20x85 20x130 20x200	C7 – C8	KSL-3DF ρ ≥ 1,4 240x175x113		M8 - M16 HR-M6 - HR-M10	16x85 16x130 20x85 20x130	C9 - C10
KSL-8DF ρ ≥ 1,4 248x240x238		M8-M16 HR-M6 - HR-M10	16x130 20x130 20x200	C11 - C12	KSL-12DF ρ ≥ 1,4 498x175x238		M8 - M16 HR-M6 - HR-M10	16x130 20x130	C13 - C14
Solid clay bricks acc. to EN 771-1									
Mz-1DF ρ ≥ 2,0 ≥ 240x115x55		M8 - M16 HR-M6 - HR-M10	12x80 16x85 16x130 20x85 20x130 20x200	C15 - C16	Mz – 2 DF ρ ≥ 2,0 ≥ 240x115x113		M8 - M16 HR-M6 - HR-M10	12x80 16x85 16x130 20x85 20x130 20x200	C17 - C18

naming density [kg/dm³] dimensions LxBxH [mm]	picture	anchor rods	perforated sleeve	Annex	naming density [kg/dm³] dimensions LxBxH [mm]	picture	anchor rods	perforated sleeve	Annex
Hollow clay bricks acc. to EN 771-1									
Hlz-10DF ρ ≥ 1,25 300x240x249		M8 - M16 HR-M6 - HR-M10	12x80 16x85 16x130 20x85 20x130 20x200	C19 - C20	Porotherm Homebric ρ ≥ 0,7 500x200x299		M8 - M16 HR-M6 - HR-M10	12x80 16x85 16x130 20x85 20x130	C21 - C22
BGV Thermo ρ ≥ 0,6 500x200x314		M8 - M16 HR-M6 - HR-M10	12x80 16x85 16x130 20x85 20x130	C23 - C24	Brique creuse C40 ρ ≥ 0,7 500x200x200		M8 - M16 HR-M6 - HR-M10	12x80 16x85 16x130 20x85 20x130	C29 - C30
Calibric R+ ρ ≥ 0,6 500x200x314		M8 - M16 HR-M6 - HR-M10	12x80 16x85 16x130 20x85 20x130	C25 - C26	Blocchi Leggeri ρ ≥ 0,6 250x120x250		M8 - M16 HR-M6 - HR-M10	12x80 16x85 16x130 20x85 20x130	C31 - C32
Urbanbric ρ ≥ 0,7 560x200x274		M8 - M16 HR-M6 - HR-M10	12x80 16x85 16x130 20x85 20x130	C27 - C28	Doppio Uni ρ ≥ 0,9 250x120x120		M8 - M16 HR-M6 - HR-M10	12x80 16x85 16x130 20x85 20x130	C33 - C34

RESINA VINILESTER + SIN ESTIRENO LUSAN

Intended Use
Brick types and properties with corresponding fastening elements

Annex B 3

Installation: steel brush C1-

Table B2: Installation parameters in autoaerated concrete AAC and solid masonry (without sleeve)

Anchor size			**M8**	**M10**	**HR-M6**	**M12**	**HR-M8**	**M16**	**HR-M10**
nominal drill hole diameter	d_0	[mm]	10	12		14		18	
drill hole depth	h_0	[mm]	80	90		100		100	
effective anchorage depth	h_{ef}	[mm]	80	90		100		100	
minimum wall thickness	h_{min}	[mm]	h_{ef} + 30						
Diameter of clearance hole in the fixture	$d_f \leq$	[mm]	9	12	7	14	9	18	12
Brush			C1-10	C1-12		C1-14		C1-18	
Diameter of steel brush	$d_b \geq$	[mm]	10,5	12,5		14,5		18,5	

Table B3: Installation parameters in solid and hollow masonry (with sleeve)

Anchor size				**M8**	**M8 / M10 / HR-M6**			**M12 / M16 / HR-M8 / HR-M10**		
sleeve SH				**12x80**	**16x85**	**16x130**	**16x130/330**	**20x85**	**20x130**	**20x200**
nominal drill hole diameter		d_0	[mm]	12	16	16	16	20	20	20
drill hole depth		h_0	[mm]	85	90	135	330	90	135	205
effective anchorage depth		h_{ef}	[mm]	80	85	130	130	85	130	200
minimum wall thickness		h_{min}	[mm]	115	115	195	195	115	195	240
Diameter of clearance hole in the fixture	prepositioned installation	$d_f \leq$	[mm]	9	7 (HR-M6) / 9 (M8) / 12 (M10)			9 (HR-M8) / 12 (HR-M10) / 14 (M12) / 18 (M16)		
	push through installation	$d_f \leq$	[mm]	14	18			22		
Brush				C1-12	C1-16			C1-20		
Diameter of steel brush		d_b	[mm]	12,5	16,5			20,5		

Hand pump (Volume 750 ml)

Table B4: Maximum working time and minimum curing time VINI

Temperature in the base material T	Temperature of cartridge	Gelling- / working time	Minimum curing time in dry base material [1)]
0°C bis + 4 °C	+5°C bis +40°C	45 min	7 h
+ 5 °C bis + 9 °C		25 min	2 h
+ 10 °C bis + 19 °C		15 min	80 min
+ 20 °C bis + 29 °C		6 min	45 min
+ 30 °C bis + 34 °C		4 min	25 min
+ 35 °C bis + 39 °C		2 min	20 min
+ 40°C		1,5 min	15 min

[1)] In wet base material the curing time **must** be doubled

Table B5: Maximum working time and minimum curing time VININ

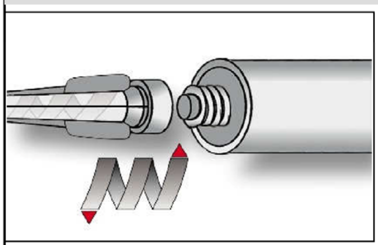
Temperature in the base material T	Temperature of cartridge	Gelling- / working time	Minimum curing time in dry base material [1)]
0 °C bis + 4 °C	-20°C bis +10°C	10 min	2,5 h
+ 5 °C bis + 9 °C		6 min	80 min
+ 10°C		6 min	60 min

[1)] In wet base material the curing time **must** be doubled

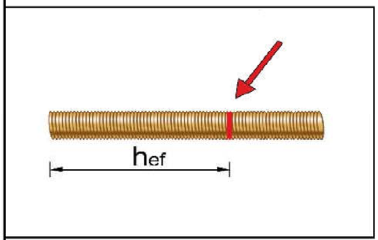
RESINA VINILESTER + SIN ESTIRENO LUSAN	**Annex B 5**
Intended Use Gelling and curing times	

Installation Instructions

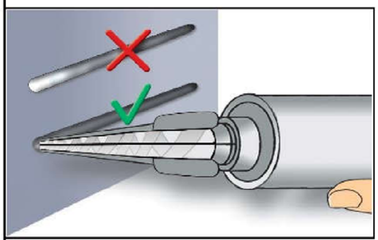
Preparation of cartridge



1. Remove the cap and attach the supplied static-mixing nozzle to the cartridge and load the cartridge into the correct dispensing tool. In case of a foil tube cartridge, cut off the clip before use. For every working interruption longer than the recommended working time (Table B4 and B5) as well as for new cartridges, a new static-mixer shall be used.

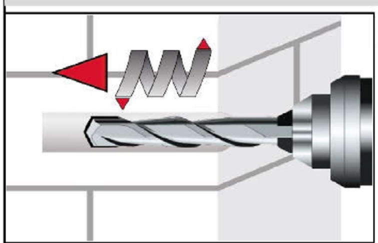


2. The position of the embedment depth shall be marked on the threaded rod.



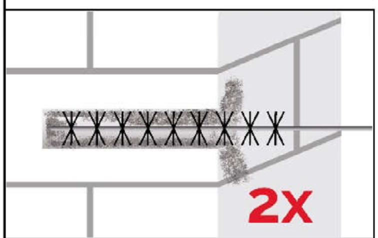
3. Initial adhesive is not suitable for fixing the anchor. Prior to dispensing into the anchor hole, squeeze out separately a minimum of three full strokes, for foil tube cartridges six full strokes and discard non-uniformly mixed adhesive components until the mortar shows a consistent grey colour.

Installation in solid masonry (without sleeve)



4. Holes to be drilled perpendicular to the surface of the base material by using a hard-metal tipped hammer drill bit. Drill a hole, with drill method according to Annex C4 – C40, into the base material, with nominal drill hole diameter and bore hole depth according to the size and embedment depth required by the selected anchor.

5a. Starting from the bottom or back of the bore hole, blow the hole clean with handpump (Annex B4) a minimum of two times.



5b. Attach an appropriate sized wire brush > $d_{b,min}$ (Table B2) to a drill or a cordless screwdriver and brush the hole clean with a minimum of two times in a twisting motion. If the bore hole ground is not reached with the brush, a brush extension must be used.

RESINA VINILESTER + SIN ESTIRENO LUSAN	**Annex B 6**
Intended Use Installation instructions Solid masonry and Autoclaved Aerated Concrete	

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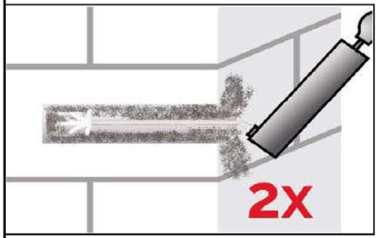
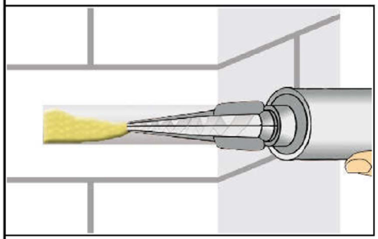
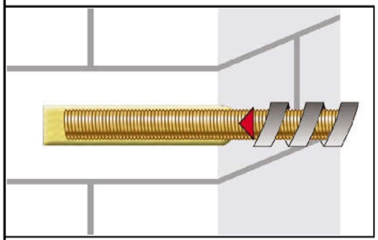
Installation instructions (continuation)



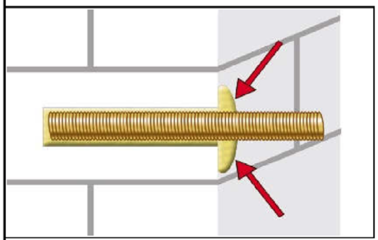
5c. Finally blow the hole clean again with handpump (Annex B4) a minimum of two times



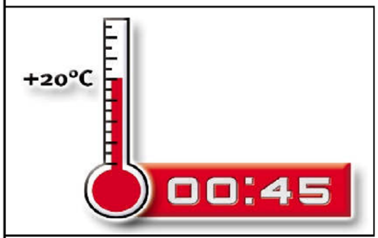
6. Starting from the bottom or back of the cleaned anchor hole, fill the hole up to approximately two-thirds with adhesive. Slowly withdraw the static mixing nozzle as the hole fills to avoid creating air pockets. If the bottom or back of the anchor hole is not reached, an appropriate extension nozzle must be used. Observe the gel-/ working times given in Table B4 + B5.



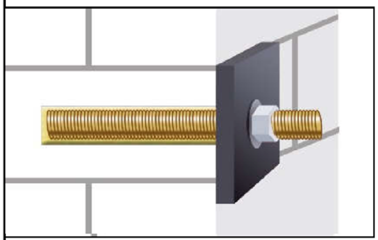
7. Push the threaded rod into the anchor hole while turning slightly to ensure positive distribution of the adhesive until the embedment depth is reached. The anchor shall be free of dirt, grease, oil or other foreign material.



8. Be sure that the anular gap is fully filled with mortar. For push through installation the hole in the fixture must also be fully filled with mortar. If no excess mortar is visible at the top of the hole, the application has to be renewed.



9. Allow the adhesive to cure to the specified curing time prior to applying any load or torque. Do not move or load the anchor until it is fully cured (attend Table B4 + B5).



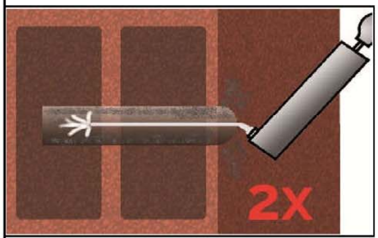
10. After full curing, the fixture can be installed with up to the max. installation torque (See parameters of brick Annex C4 to Annex C40) by using a calibrated torque wrench.

RESINA VINILESTER + SIN ESTIRENO LUSAN	**Annex B 7**
Intended Use Installation instructions Solid masonry and Autoclaved Aerated Concrete	

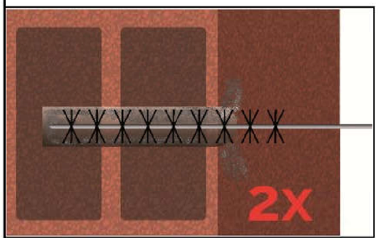
Installation instructions (continuation)

Installation in solid and hollow masonry (with sleeve)

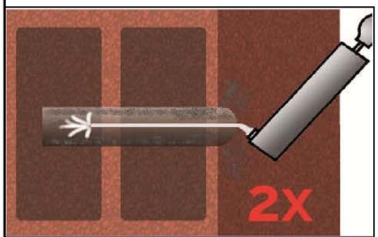
4. Holes to be drilled perpendicular to the surface of the base material by using a hard-metal tipped hammer drill bit. Drill a hole, with drill method according to Annex C4 – C40, into the base material, with nominal drill hole diameter and bore hole depth according to the size and embedment depth required by the selected anchor.



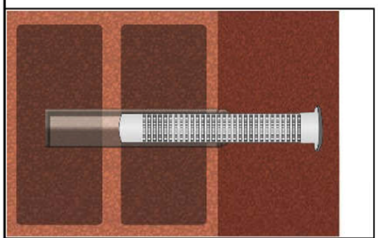
5a. Starting from the bottom or back of the bore hole, blow the hole clean with handpump (Annex B4) a minimum of two times.



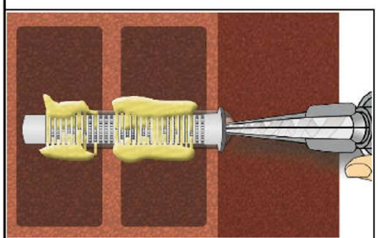
5b. Attach an appropriate sized wire brush > $d_{b,min}$ (Table B3) to a drill or a cordless screwdriver and brush the hole clean with a minimum of two times in a twisting motion. If the bore hole ground is not reached with the brush, a brush extension must be used.



5c. Finally blow the hole clean again with handpump (Annex B4) a minimum of two times

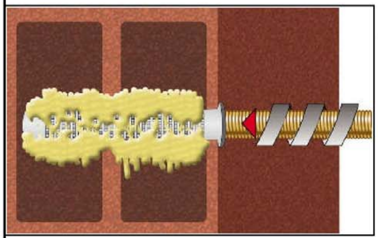


6. Insert the perforated sleeve flush with the surface of the masonry or plaster. Only use sleeves that have the right length. Never cut the sleeve. For installation through insulation the sleeve SH 16x130/330 shall be cutted at the top end according to the insulation thickness.

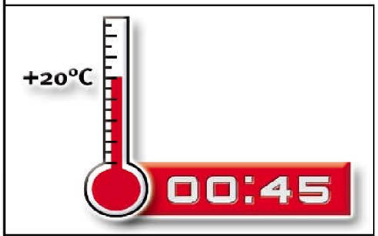


7. Starting from the bottom or back fill the sleeve with adhesive. For embedment depth equal to or larger than 130 mm an extension nozzle shall be used. For quantity of mortar attend cartridges label installation instructions. For push through installation the sleeve within the fixture must also be fully filled with mortar. Observe the gel-/ working times given in Table B4 + B5.

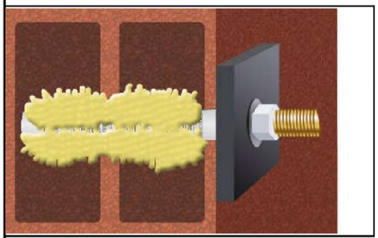
Installation instructions (continuation)



8. Push the threaded rod into the anchor hole while turning slightly to ensure positive distribution of the adhesive until the embedment depth is reached. The anchor shall be free of dirt, grease, oil or other foreign material.



9. Allow the adhesive to cure to the specified curing time prior to applying any load or torque. Do not move or load the anchor until it is fully cured (attend Table B4 + B5).



10. After full curing, the fixture can be installed with up to the max. installation torque (See parameters of brick Annex C4 to Annex C40) by using a calibrated torque wrench.

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

base material	anchor size	β-Factor					
		T_a: 40°C / 24°C		T_b: 80°C / 50°C		T_c: 120°C / 72°C	
		d/d	w/d w/w	d/d	w/d w/w	d/d	w/d w/w
Autoclaved aerated concrete	all sizes	0,95	0,86	0,81	0,73	0,81	0,73
Calcium silica bricks	$d_0 \leq 14$ mm	0,93	0,80	0,87	0,74	0,65	0,56
	$d_0 \geq 16$ mm	0,93	0,93	0,87	0,87	0,65	0,65
Clay Bricks	all sizes	0,86	0,86	0,86	0,86	0,73	0,73
Concrete bricks	$d_0 \leq 12$ mm	0,93	0,80	0,87	0,74	0,65	0,56
	$d_0 \geq 16$ mm	0,93	0,93	0,87	0,87	0,65	0,65

RESINA VINILESTER + SIN ESTIRENO LUSAN

Performances
β-factors for job site testing under tension load

Annex C 1

Table C2: Characteristic steel resistance

Anchor size			HR-M6	HR-M8	HR-M10	M8	M10	M12	M16
Characteristic tension resistance									
steel, property class 4.6	$N_{Rk,s}$	[kN]	- 1)	- 1)	- 1)	15	23	34	63
	γ_{Ms}	[-]		- 1)			2,0		
steel, property class 4.8	$N_{Rk,s}$	[kN]	- 1)	- 1)	- 1)	15	23	34	63
	γ_{Ms}	[-]		- 1)			1,5		
steel, property class 5.6	$N_{Rk,s}$	[kN]	- 1)	- 1)	- 1)	18	29	42	79
	γ_{Ms}	[-]		- 1)			2,0		
steel, property class 5.8	$N_{Rk,s}$	[kN]	10	17	29	18	29	42	79
	γ_{Ms}	[-]		1,5			1,5		
steel, property class 8.8	$N_{Rk,s}$	[kN]	16	27	46	29	46	67	126
	γ_{Ms}	[-]		1,5			1,5		
Stainless steel A4 / HCR, property class 70	$N_{Rk,s}$	[kN]	14	26	41	26	41	59	110
	γ_{Ms}	[-]		1,87			1,87		
Stainless steel A4 / HCR, property class 80	$N_{Rk,s}$	[kN]	16	29	46	29	46	67	126
	γ_{Ms}	[-]		1,6			1,6		
Characteristic shear resistance									
steel, property class 4.6	$V_{Rk,s}$	[kN]	- 1)	- 1)	- 1)	7	12	17	31
	γ_{Ms}	[-]		- 1)			1,67		
steel, property class 4.8	$V_{Rk,s}$	[kN]	- 1)	- 1)	- 1)	7	12	17	31
	γ_{Ms}	[-]		- 1)			1,25		
steel, property class 5.6	$V_{Rk,s}$	[kN]	- 1)	- 1)	- 1)	9	15	21	39
	γ_{Ms}	[-]		- 1)			1,67		
steel, property class 5.8	$V_{Rk,s}$	[kN]	5	9	15	9	15	21	39
	γ_{Ms}	[-]		1,25			1,25		
steel, property class 8.8	$V_{Rk,s}$	[kN]	8	14	23	15	23	34	63
	γ_{Ms}	[-]		1,25			1,25		
Stainless steel A4 / HCR, property class 70	$V_{Rk,s}$	[kN]	7	13	20	13	20	30	55
	γ_{Ms}	[-]		1,56			1,56		
Stainless steel A4 / HCR, property class 80	$V_{Rk,s}$	[kN]	8	15	23	15	23	34	63
	γ_{Ms}	[-]		1,33			1,33		
Characteristic bending moment									
steel, property class 4.6	$M^0_{Rk,s}$	[Nm]	- 1)	- 1)	- 1)	15	30	52	133
	γ_{Ms}	[-]		- 1)			1,67		
steel, property class 4.8	$M^0_{Rk,s}$	[Nm]	- 1)	- 1)	- 1)	15	30	52	133
	γ_{Ms}	[-]		- 1)			1,25		
steel, property class 5.6	$M^0_{Rk,s}$	[Nm]	- 1)	- 1)	- 1)	19	37	66	167
	γ_{Ms}	[-]		- 1)			1,67		
steel, property class 5.8	$M^0_{Rk,s}$	[Nm]	8	19	37	19	37	66	167
	γ_{Ms}	[-]		1,25			1,25		
steel, property class 8.8	$M^0_{Rk,s}$	[Nm]	12	30	60	30	60	105	266
	γ_{Ms}	[-]		1,25			1,25		
Stainless steel A4 / HCR, property class 70	$M^0_{Rk,s}$	[Nm]	11	26	52	26	52	92	233
	γ_{Ms}	[-]		1,56			1,56		
Stainless steel A4 / HCR, property class 80	$M^0_{Rk,s}$	[Nm]	12	30	60	30	60	105	266
	γ_{Ms}	[-]		1,33			1,33		

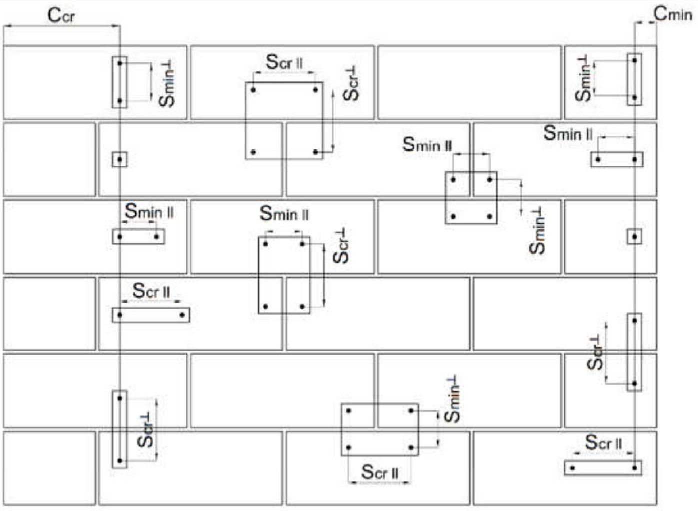
1) Not part of the ETA

RESINA VINILESTER + SIN ESTIRENO LUSAN

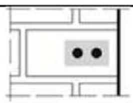
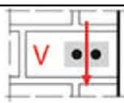
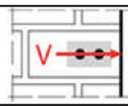
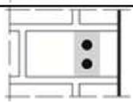
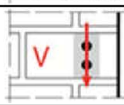
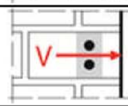
Performances
Characteristic resistance under tension and shear load – steel failure

Annex C 2

Spacing and edge distances



c_{cr}	=	Char. Edge distance
c_{min}	=	Minimum Edge distance
$s_{cr,II}$; ($s_{min,II}$)	=	Characteristic (minimum) spacing for anchors placed parallel to horizontal joint
$s_{cr,\perp}$; ($s_{min,\perp}$)	=	Characteristic (minimum) spacing for anchors placed perpendicular to horizontal joint

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

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

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

Equations depend on anchor position and load direction (see table above). Reduction factor, group factor and resistances see annex C4 - C48. Reduction for installation in joints see annex B1.

RESINA VINILESTER + SIN ESTIRENO LUSAN	**Annex C 3**
Performances Definition of the reduction- and group factors	

Brick type: Autoclaved aerated concrete – AAC

Table C3: Stone description

Brick type		Autoclaved aerated concrete AAC	
Density	ρ [kg/dm³]	0,35 – 0,6	
Compressive strength	f_b [N/mm²]	2, 4, 6	
Code		EN 771-4	
Producer (Country)		e.g. Porit (DE)	
Brick dimensions	[mm]	≥ 499 x 240 x 249	
Drilling method		Rotary drilling	

Table C4: Installation parameter

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

Table C5: Reduction factors for single anchors at the edge

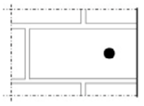
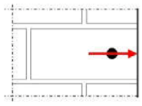
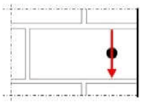
Tension load			Shear load					
			Perpendicular to the free edge			Parallel to the free edge		
	with c ≥	$\alpha_{edge,N}$		with c ≥	$\alpha_{edge,V\perp}$		with c ≥	$\alpha_{edge,VII}$
	50	0,85		50	0,12		50	0,70
				125	0,50		125	0,85
	150	1,00		210	1,00		150	1,00

Table C6: Factors for anchor groups under tension load

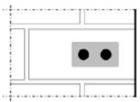
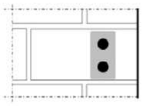
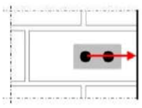
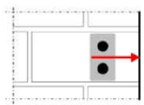
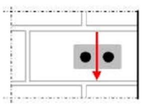
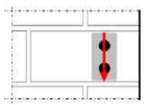
Anchor position parallel to hor. joint				Anchor position perpendicular to hor. joint			
	with c ≥	with s ≥	$\alpha_{g II,N}$		with c ≥	with s ≥	$\alpha_{g \perp,N}$
	50	50	1,10		50	50	0,75
	150	50	1,25		150	50	0,90
	150	300	2,00		150	250	2,00

Table C7: Factors for anchor groups under shear load

	Anchor position parallel to hor. joint				Anchor position perpendicular to hor. joint			
Shear load perpendicular to the free edge		with c ≥	with s ≥	$\alpha_{g II,V\perp}$		with c ≥	with s ≥	$\alpha_{g \perp,V\perp}$
		50	50	0,20		50	50	0,25
		210	50	1,60		210	50	1,80
		210	300	2,00		210	250	2,00
Shear load parallel to the free edge		with c ≥	with s ≥	$\alpha_{g II,VII}$		with c ≥	with s ≥	$\alpha_{g \perp,VII}$
		50	50	1,15		50	50	0,80
		150	50	1,60		150	50	1,10
		150	300	2,00		150	250	2,00

RESINA VINILESTER + SIN ESTIRENO LUSAN

Performances Autoclaved aerated concrete - AAC
Description of the stone, Installation parameters, Reduction- and Group factors

Annex C 4

Brick type: Autoclaved aerated concrete – AAC

Table C8: Characteristic values of tension and shear load resistances

Anchor size	Perforated sleeve	Effecitve Anchorage depth	Characteristic Resistances with $c \geq c_{cr}$ and $s \geq s_{cr}$						
			Use condition						
			d/d			w/d w/w			d/d w/d w/w
			40°C/24°C	80°C/50°C	120°C/72°C	40°C/24°C	80°C/50°C	120°C/72°C	All Temperature ranges
		h_{ef}	$N_{Rk,b} = N_{Rk,p}$			$N_{Rk,b} = N_{Rk,p}$			$V_{Rk,b}$ [1)]
		[mm]	[kN]						
Compressive strength f_b = 2 N/mm²; Density ρ ≥ 0,35 kg/dm³									
M8	-	≥ 80	1,2	0,9	0,9	0,9	0,9	0,9	1,5
M10 / HR-M6	-	≥ 90	1,2	0,9	0,9	0,9	0,9	0,9	2,5
M12 / HR-M8	-	≥ 100	2,0	1,5	1,5	1,5	1,5	1,5	2,5
M16 / HR-M10	-	≥ 100	2,0	1,5	1,5	1,5	1,5	1,5	2,5
M8	12x80	80	1,2	0,9	0,9	0,9	0,9	0,9	1,5
M8 / M10/ HR-M6	16x85	85	1,2	0,9	0,9	0,9	0,9	0,9	2,5
	16x130	130	1,2	0,9	0,9	0,9	0,9	0,9	2,5
M12 / M16 / HR-M8 / HR-M10	20x85	85	2,0	1,5	1,5	1,5	1,5	1,5	2,5
	20x130	130	2,0	1,5	1,5	1,5	1,5	1,5	2,5
	20x200	200	2,0	1,5	1,5	1,5	1,5	1,5	2,5

[1)] $V_{Rk,c}$ according to Annex C3

Anchor size	Perforated sleeve	Effecitve Anchorage depth	Characteristic Resistances with $c \geq c_{cr}$ and $s \geq s_{cr}$						
			Use condition						
			d/d			w/d w/w			d/d w/d w/w
			40°C/24°C	80°C/50°C	120°C/72°C	40°C/24°C	80°C/50°C	120°C/72°C	All Temperature ranges
		h_{ef}	$N_{Rk,b} = N_{Rk,p}$			$N_{Rk,b} = N_{Rk,p}$			$V_{Rk,b}$ [1)]
		[mm]	[kN]						
Compressive strength f_b = 4 N/mm²; Density ρ ≥ 0,50 kg/dm³									
M8	-	≥ 80	3,0	2,5	2,0	2,5	2,0	2,0	4,5
M10 / HR-M6	-	≥ 90	3,0	2,5	2,0	2,5	2,0	2,0	7,5
M12 / HR-M8	-	≥ 100	5,0	4,5	4,0	4,5	4,0	4,0	7,5
M16 / HR-M10	-	≥ 100	5,0	4,5	4,0	4,5	4,0	4,0	7,5
M8	12x80	80	3,0	2,5	2,0	2,5	2,0	2,0	4,5
M8 / M10/ HR-M6	16x85	85	3,0	2,5	2,0	2,5	2,0	2,0	7,5
	16x130	130	3,0	2,5	2,0	2,5	2,0	2,0	7,5
M12 / M16 / HR-M8 / HR-M10	20x85	85	5,0	4,5	4,0	4,5	4,0	4,0	7,5
	20x130	130	5,0	4,5	4,0	4,5	4,0	4,0	7,5
	20x200	200	5,0	4,5	4,0	4,5	4,0	4,0	7,5

[1)] $V_{Rk,c}$ according to Annex C3

RESINA VINILESTER + SIN ESTIRENO LUSAN

Performances Autoclaved aerated concrete - AAC
Characteristic Resistances and Displacements

Annex C 5

Brick type: Autoclaved aerated concrete – AAC									
Anchor size	Perforated sleeve	Effecitve Anchorage depth	Characteristic Resistances with $c \geq c_{cr}$ and $s \geq s_{cr}$						
			Use condition						
			d/d			w/d w/w			d/d w/d w/w
			40°C/24°C	80°C/50°C	120°C/72°C	40°C/24°C	80°C/50°C	120°C/72°C	All Temperature ranges
		h_{ef}	$N_{Rk,b} = N_{Rk,p}$			$N_{Rk,b} = N_{Rk,p}$			$V_{Rk,b}$ 1)
		[mm]	[kN]						
Compressive strength f_b = 6 N/mm²; Density $\rho \geq 0{,}65$ kg/dm³									
M8	-	≥ 80	4,0	3,5	3,0	3,5	3,0	3,0	6,0
M10 / HR-M6	-	≥ 90	4,0	3,5	3,0	3,5	3,0	3,0	10,0
M12 / HR-M8	-	≥ 100	7,0	6,0	5,5	6,5	5,5	5,5	10,0
M16 / HR-M10	-	≥ 100	7,0	6,0	5,5	6,5	5,5	5,5	10,0
M8	12x80	80	4,0	3,5	3,0	3,5	3,0	3,0	6,0
M8 / M10/ HR-M6	16x85	85	4,0	3,5	3,0	3,5	3,0	3,0	10,0
	16x130	130	4,0	3,5	3,0	3,5	3,0	3,0	10,0
M12 / M16 / HR-M8 / HR-M10	20x85	85	7,0	6,0	5,5	6,5	5,5	5,5	10,0
	20x130	130	7,0	6,0	5,5	6,5	5,5	5,5	10,0
	20x200	200	7,0	6,0	5,5	6,5	5,5	5,5	10,0

1) $V_{Rk,c}$ according to Annex C3

Table C9: Displacements

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

Brick type: Solid calcium silica brick KS-NF

Table C10: Stone description

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

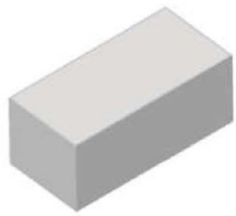


Table C11: Installation parameter

Anchor size		[-]	M8	M10	M12	M16	HR-M6	HR-M8	HR-M10
Installation torque	T_{inst}	[Nm]	≤ 10	≤ 10	≤ 15	≤ 15	≤ 10	≤ 10	≤ 10
Char. Edge distance	c_{cr}	[mm]	150 (for shear loads perpendicular to the free edge: c_{cr} = 240)						
Minimum Edge Distance	c_{min}	[mm]	60						
Characteristic Spacing	$s_{cr,II}$	[mm]	240						
	$s_{cr,\perp}$	[mm]	150						
Minimum Spacing	s_{min}	[mm]	75						

Table C12: Reduction factors for single anchors at the edge

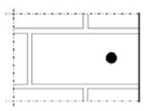
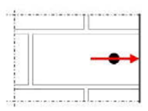
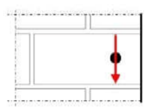
Tension load			Shear load					
			Perpendicular to the free edge			Parallel to the free edge		
	with c ≥	$\alpha_{edge,N}$		with c ≥	$\alpha_{edge,V\perp}$		with c ≥	$\alpha_{edge,VII}$
	60	0,50		60	0,30		60	0,60
	100	0,50		100	0,50		100	1,00
	150	1,00		240	1,00		150	1,00

Table C13: Factors for anchor groups under tension load

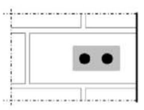
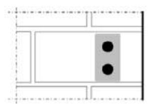
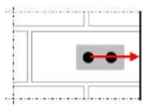
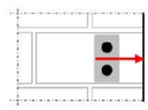
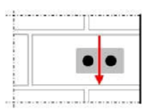
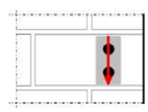
Anchor position parallel to hor. joint				Anchor position perpendicular to hor. joint			
	with c ≥	with s ≥	$\alpha_{g\,II,N}$		with c ≥	with s ≥	$\alpha_{g\perp,N}$
	60	75	0,70		60	75	1,15
	150	75	1,40		150	75	2,00
	150	240	2,00		150	150	2,00

Table C14: Factors for anchor groups under shear load

	Anchor position parallel to hor. joint				Anchor position perpendicular to hor. joint			
Shear load perpendicular to the free edge		with c ≥	with s ≥	$\alpha_{g\,II,V\perp}$		with c ≥	with s ≥	$\alpha_{g\perp,V\perp}$
		60	75	0,75		60	75	0,90
		150	75	2,00		150	75	2,00
		150	240	2,00		150	150	2,00
Shear load parallel to the free edge		with c ≥	with s ≥	$\alpha_{g\,II,VII}$		with c ≥	with s ≥	$\alpha_{g\perp,VII}$
		60	75	2,00		60	75	2,00
		150	75	2,00		150	75	2,00
		150	240	2,00		150	150	2,00

RESINA VINILESTER + SIN ESTIRENO LUSAN

Performances Solid calcium silica brick KS-NF
Description of the stone, Installation parameters, Reduction- and Group factors

Annex C 7

Deutsches Institut für Bautechnik DIBt

Brick type: Solid calcium silica brick KS-NF

Table C15: Characteristic values of tension and shear load resistances

Anchor size	Perforated sleeve	Effective Anchorage depth	Characteristic Resistances with $c \geq c_{cr}$ and $s \geq s_{cr}$						
			Use condition						
			d/d			w/d w/w			d/d w/d w/w
			40°C/24°C	80°C/50°C	120°C/72°C	40°C/24°C	80°C/50°C	120°C/72°C	All Temperature ranges
		h_{ef}	$N_{Rk,b} = N_{Rk,p}$			$N_{Rk,b} = N_{Rk,p}$			$V_{Rk,b}$ 2)
		[mm]	[kN]						
Compressive strength $f_b \geq 28$ N/mm² 1)									
M8	-	≥ 80	7,0	6,5	5,0	6,0	5,5	4,0	7,0
M10 / HR-M6	-	≥ 90	7,0	6,5	5,0	6,0	5,5	4,0	
M12 / HR-M8	-	≥ 100	7,0	6,5	5,0	6,0	5,5	4,0	
M16 / HR-M10	-	≥ 100	7,0	6,5	5,0	7,0	6,5	5,0	
M8	12x80	80	7,0	6,5	5,0	6,0	5,5	4,0	
M8 / M10/ HR-M6	16x85	85	7,0	6,5	5,0	7,0	6,5	5,0	
	16x130	130	7,0	6,5	5,0	7,0	6,5	5,0	
M12 / M16 / HR-M8 / HR-M10	20x85	85	7,0	6,5	5,0	7,0	6,5	5,0	
	20x130	130	7,0	6,5	5,0	7,0	6,5	5,0	
	20x200	200	7,0	6,5	5,0	7,0	6,5	5,0	

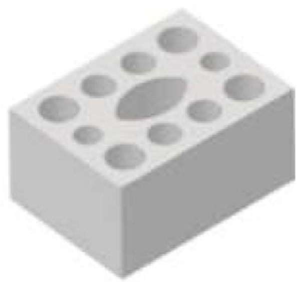
1) For lower compressive strengths resistances must be multiplied by the conversion factor according to Table C10. For stones with higher strengths, the shown values are valid without conversion.
2) $V_{Rk,c}$ according to Annex C3

Table C16: Displacements

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

Brick type: Hollow Calcium silica brick KSL-3DF

Table C17: Stone description

Brick type	Hollow calcium silica brick KSL-3DF	
Density ρ [kg/dm³]	≥ 1,4	
Compressive strength f_b [N/mm²]	≥ 14	
Conversion factor for lower compressive strengths	$(f_b / 14)^{0,75} \leq 1,0$	
Code	EN 771-2	
Producer (Country)	e.g. KS-Wemding (DE)	
Brick dimensions [mm]	≥ 240 x 175 x 113	
Drilling method	Rotary drilling	

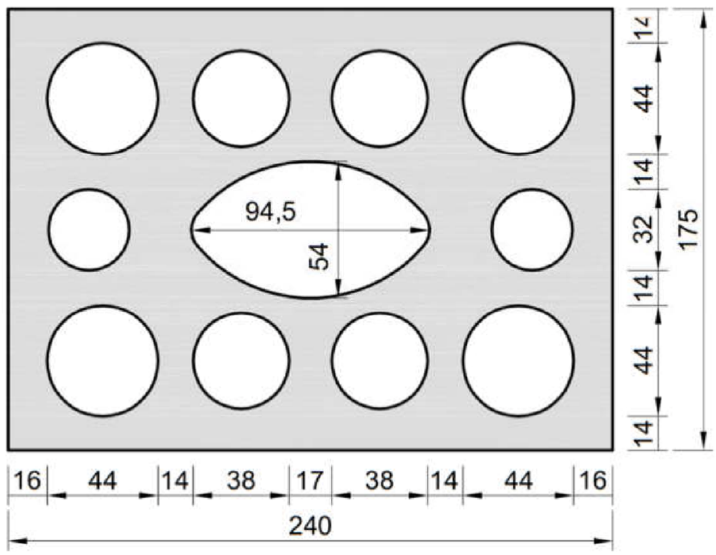
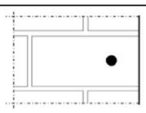
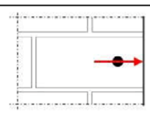
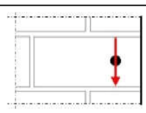


Table C18: Installation parameter

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

Table C19: Reduction factors for single anchors at the edge

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

RESINA VINILESTER + SIN ESTIRENO LUSAN

Performances Hollow Calcium silica brick KSL-3DF
Description of the stone, Installation parameters, Reductionfactors

Annex C 9

Brick type: Hollow Calcium silica brick KSL-3DF

Table C20: Factors for anchor groups under tension load

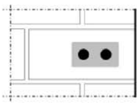
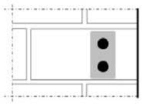
Anchor position parallel to hor. joint				Anchor position perpendicular to hor. joint			
	with c ≥	with s ≥	$\alpha_{g\,II,\,N}$		with c ≥	with s ≥	$\alpha_{g\,\perp,\,N}$
	60	120	1,50		60	120	1,00
	120	120	2,00				
	120	240	2,00		120	120	2,00

Table C21: Factors for anchor groups under shear load

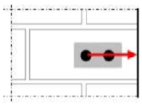
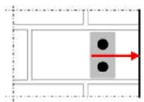
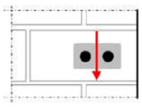
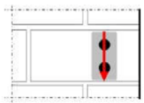
	Anchor position parallel to hor. joint				Anchor position perpendicular to hor. joint			
Shear load perpendicular to the free edge		with c ≥	with s ≥	$\alpha_{g\,II,V\,\perp}$		with c ≥	with s ≥	$\alpha_{g\,\perp,\,V\,\perp}$
		60	120	0,30		60	120	0,30
		120	120	1,00				
		120	240	2,00		240	120	2,00
Shear load parallel to the free edge		with c ≥	with s ≥	$\alpha_{g\,II,V\,II}$		with c ≥	with s ≥	$\alpha_{g\,\perp,V\,II}$
		60	120	1,00		60	120	1,00
		120	120	1,60				
		120	240	2,00		120	120	2,00

Table C22: Characteristic values of tension and shear load resistances

Anchor size	Perforated sleeve	Effecitve Anchorage depth	Characteristic Resistances with $c \geq c_{cr}$ and $s \geq s_{cr}$						
			Use condition						
			d/d			w/d w/w			d/d w/d w/w
			40°C/24°C	80°C/50°C	120°C/72°C	40°C/24°C	80°C/50°C	120°C/72°C	All Temperature ranges
		h_{ef}	$N_{Rk,b} = N_{Rk,p}$			$N_{Rk,b} = N_{Rk,p}$			$V_{Rk,b}$ 2)
		[mm]	[kN]						
Compressive strength $f_b \geq 14$ N/mm² 1)									
M8 / M10/ HR-M6	16x85	85	2,5	2,5	1,5	2,5	2,5	1,5	6,0
	16x130	130	2,5	2,5	2,0	2,5	2,5	2,0	6,0
M12 / M16 / HR-M8 / HR-M10	20x85	85	6,5	6,0	4,5	6,5	6,0	4,5	6,0
	20x130	130	6,5	6,0	4,5	6,5	6,0	4,5	6,0

1) For lower compressive strengths resistances must be multiplied by the conversion factor according to Table C17. For stones with higher strengths, the shown values are valid without conversion.
2) $V_{Rk,c}$ according to Annex C3

Table C23: Displacements

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

RESINA VINILESTER + SIN ESTIRENO LUSAN

Performances Hollow Calcium silica brick KSL-3DF
Group factors, characteristic Resistances and Displacements

Annex C 10

Brick type: Hollow Calcium silica brick KSL-8DF

Table C24: Stone description

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

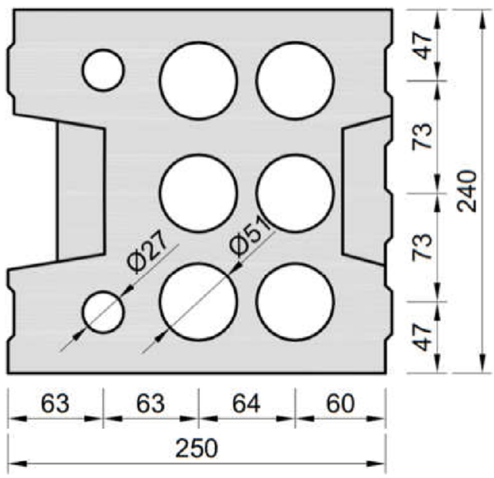
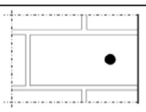
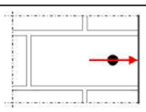
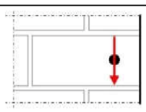


Table C25: Installation parameter

Anchor size		[-]	M8	M10	M12	M16	HR-M6	HR-M8	HR-M10
Installation torque	T_{inst}	[Nm]	≤ 5	≤ 5	≤ 8	≤ 8	≤ 5	≤ 8	≤ 8
Char. Edge distance	c_{cr}	[mm]	120 (for shear loads perpendicular to the free edge: c_{cr} = 240)						
Minimum Edge Distance	c_{min}	[mm]	50						
Characteristic Spacing	$s_{cr,II}$	[mm]	250						
	$s_{cr,\perp}$	[mm]	120						
Minimum Spacing	s_{min}	[mm]	50						

Table C26: Reduction factors for single anchors at the edge

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

RESINA VINILESTER + SIN ESTIRENO LUSAN

Performances Hollow Calcium silica brick KSL-8DF
Description of the stone, Installation parameters, Reductionfactors

Annex C 11

Brick type: Hollow Calcium silica brick KSL-8DF

Table C27: Factors for anchor groups under tension load

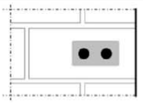
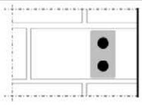
Anchor position parallel to hor. joint				Anchor position perpendicular to hor. joint			
	with c ≥	with s ≥	$\alpha_{g\,II,\,N}$		with c ≥	with s ≥	$\alpha_{g\,\perp,\,N}$
	50	50	1,00		50	50	1,00
	120	250	2,00		120	120	2,00

Table C28: Factors for anchor groups under shear load

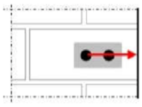
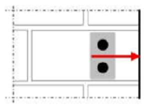
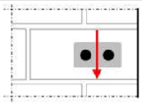
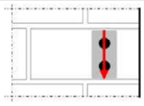
	Anchor position parallel to hor. joint				Anchor position perpendicular to hor. joint			
Shear load perpendicular to the free edge		with c ≥	with s ≥	$\alpha_{g\,II,V\,\perp}$		with c ≥	with s ≥	$\alpha_{g\,\perp,V\,\perp}$
		50	50	0,45		50	50	0,45
		250	50	1,15		250	50	1,20
		250	250	2,00		250	250	2,00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

Table C29: Characteristic values of tension and shear load resistances

Anchor size	Perforated sleeve	Effective Anchorage depth	Characteristic Resistances with $c \geq c_{cr}$ and $s \geq s_{cr}$						
			Use condition						
			d/d			w/d w/w			d/d w/d w/w
			40°C/24°C	80°C/50°C	120°C/72°C	40°C/24°C	80°C/50°C	120°C/72°C	All Temperature ranges
		h_{ef}	$N_{Rk,b} = N_{Rk,p}$			$N_{Rk,b} = N_{Rk,p}$			$V_{Rk,b}$ 2)
		[mm]	[kN]						
Compressive strength $f_b \geq 12$ N/mm² 1)									
M8 / M10/ HR-M6	16x130	130	5,0	4,5	3,5	5,0	4,5	3,5	3,5
M12 / M16 / HR-M8 / HR-M10	20x130	130	5,0	4,5	3,5	5,0	4,5	3,5	6,0
	20x200	200							

1) For lower compressive strengths resistances must be multiplied by the conversion factor according to Table C24. For stones with higher strengths, the shown values are valid without conversion.
2) $V_{Rk,c}$ according to Annex C3

Table C30: Displacements

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

RESINA VINILESTER + SIN ESTIRENO LUSAN

Performances Hollow Calcium silica brick KSL-8DF
Group factors, characteristic Resistances and Displacements

Annex C 12

Brick type: Hollow Calcium silica brick KSL-12DF

Table C31: Stone description

Brick type		Hollow Calcium silica brick KSL-12DF
Density	ρ [kg/dm³]	≥ 1,4
Compressive strength	f_b [N/mm²]	≥ 12
Conversion factor for lower compressive strengths		$(f_b / 12)^{0,75} \leq 1,0$
Code		EN 771-2
Producer (Country)		e.g. KS-Wemding (DE)
Brick dimensions	[mm]	≥ 498 x 175 x 238
Drilling method		Rotary drilling

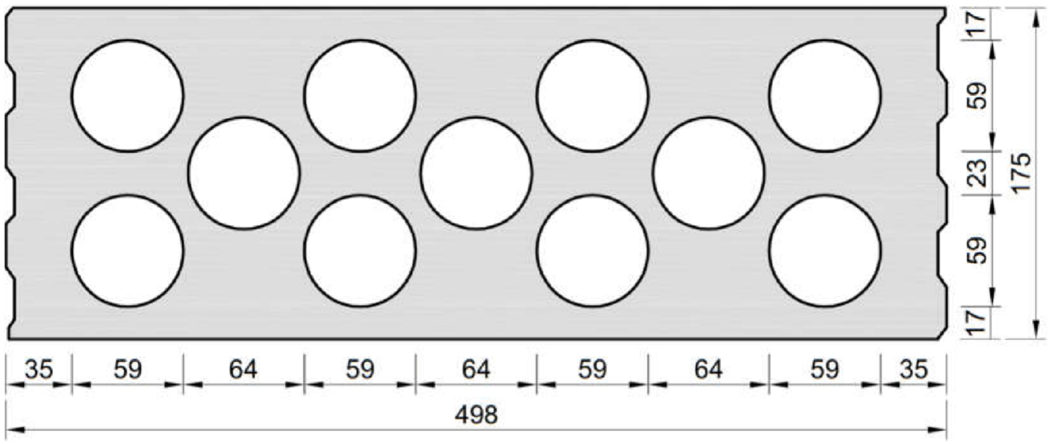
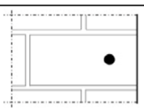
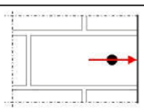
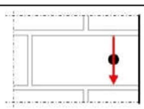


Table C32: Installation parameter

Anchor size		[-]	M8	M10	M12	M16	HR-M6	HR-M8	HR-M10
Installation torque	T_{inst}	[Nm]	≤ 4	≤ 4	≤ 5	≤ 5	≤ 4	≤ 5	≤ 5
Char. Edge distance	c_{cr}	[mm]	120 (for shear loads perpendicular to the free edge: c_{cr} = 500)						
Minimum Edge Distance	c_{min}	[mm]	50						
Characteristic Spacing	$s_{cr,II}$	[mm]	500						
	$s_{cr,\perp}$	[mm]	120						
Minimum Spacing	s_{min}	[mm]	50						

Table C33: Reduction factors for single anchors at the edge

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

Brick type: Hollow Calcium silica brick KSL-12DF

Table C34: Factors for anchor groups under tension load

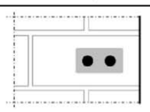
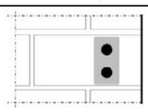
Anchor position parallel to hor. joint				Anchor position perpendicular to hor. joint			
	with c ≥	with s ≥	$\alpha_{g\,II,\,N}$		with c ≥	with s ≥	$\alpha_{g\,\perp,\,N}$
	50	50	1,50		50	50	1,00
	120	500	2,00		120	240	2,00

Table C35: Factors for anchor groups under shear load

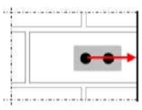
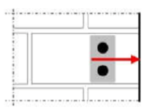
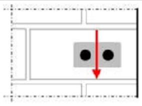
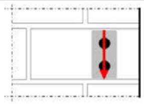
	Anchor position parallel to hor. joint				Anchor position perpendicular to hor. joint			
Shear load perpendicular to the free edge		with c ≥	with s ≥	$\alpha_{g\,II,V\,\perp}$		with c ≥	with s ≥	$\alpha_{g\,\perp,V\,\perp}$
		50	50	0,55		50	50	0,50
		500	50	1,00		500	50	1,00
		500	500	2,00		500	250	2,00
Shear load parallel to the free edge		with c ≥	with s ≥	$\alpha_{g\,II,V\,II}$		with c ≥	with s ≥	$\alpha_{g\,\perp,V\,II}$
		50	50	2,00		50	50	1,30
		120	500	2,00		120	250	2,00

Table C36: Characteristic values of tension and shear load resistances

Anchor size	Perforated sleeve	Effective Anchorage depth	Characteristic Resistances with $c \geq c_{cr}$ and $s \geq s_{cr}$						
			Use condition						
			d/d			w/d w/w			d/d w/d w/w
			40°C/24°C	80°C/50°C	120°C/72°C	40°C/24°C	80°C/50°C	120°C/72°C	All Temperature ranges
		h_{ef}	$N_{Rk,b} = N_{Rk,p}$			$N_{Rk,b} = N_{Rk,p}$			$V_{Rk,b}$ 2)
		[mm]	[kN]						
Compressive strength $f_b \geq 12$ N/mm² 1)									
M8 / M10/ HR-M6	16x130	130	3,5	3,5	2,5	3,5	3,5	2,5	3,5
M12 / M16 / HR-M8 / HR-M10	20x130	130	3,5	3,5	2,5	3,5	3,5	2,5	7,0

1) For lower compressive strengths resistances must be multiplied by the conversion factor according to Table C31. For stones with higher strengths, the shown values are valid without conversion.
2) $V_{Rk,c}$ according to Annex C3

Table C37: Displacements

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

Deutsches Institut für Bautechnik DIBt

Brick type: Solid clay brick 1DF

Table C38: Stone description

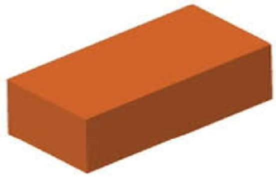
Brick type	Solid clay brick Mz-1DF	
Density ρ [kg/dm³]	≥ 2,0	
Compressive strength f_b [N/mm²]	≥ 20	
Conversion factor for lower compressive strengths	$(f_b / 20)^{0,5} \leq 1,0$	
Code	EN 771-1	
Producer (Country)	e.g. Wienerberger (DE)	
Brick dimensions [mm]	≥ 240 x 115 x 55	
Drilling method	Hammer drilling	

Table C39: Installation parameter

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

Table C40: Reduction factors for single anchors at the edge

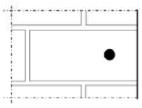
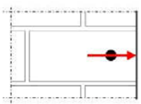
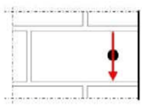
Tension load			Shear load					
			Perpendicular to the free edge			Parallel to the free edge		
	with c ≥	$\alpha_{edge,N}$		with c ≥	$\alpha_{edge,V\perp}$		with c ≥	$\alpha_{edge,VII}$
	60	0,75		60	0,10		60	0,30
				100	0,50		100	0,65
	150	1,00		240	1,00		150	1,00

Table C41: Factors for anchor groups under tension load

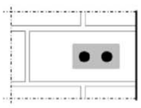
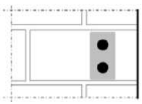
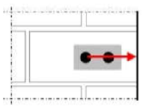
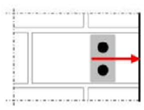
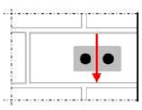
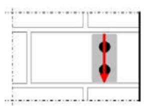
Anchor position parallel to hor. joint				Anchor position perpendicular to hor. joint			
	with c ≥	with s ≥	$\alpha_{g II,N}$		with c ≥	with s ≥	$\alpha_{g\perp,N}$
	60	65	0,85		60	65	1,00
	150	65	1,15		150	65	1,20
	150	240	2,00		150	130	2,00

Table C42: Factors for anchor groups under shear load

	Anchor position parallel to hor. joint				Anchor position perpendicular to hor. joint			
Shear load perpendicular to the free edge		with c ≥	with s ≥	$\alpha_{g II,V\perp}$		with c ≥	with s ≥	$\alpha_{g\perp,V\perp}$
		60	65	0,40		60	65	0,30
		240	65	2,00		240	65	2,00
		240	240	2,00		240	130	2,00
Shear load parallel to the free edge		with c ≥	with s ≥	$\alpha_{g II,VII}$		with c ≥	with s ≥	$\alpha_{g\perp,VII}$
		60	65	1,75		60	65	1,10
		150	65	2,00		150	65	2,00
		150	240	2,00		150	130	2,00

RESINA VINILESTER + SIN ESTIRENO LUSAN

Performances Solid clay brick 1DF
Description of the stone, Installation parameters, Reduction- and Group factors

Annex C 15

Brick type: Solid clay brick 1DF

Table C43: Characteristic values of tension and shear load resistances

Anchor size	Perforated sleeve	Effective Anchorage depth	Characteristic Resistances with $c \geq c_{cr}$ and $s \geq s_{cr}$						
			Use condition						
			d/d			w/d w/w			d/d w/d w/w
			40°C/24°C	80°C/50°C	120°C/72°C	40°C/24°C	80°C/50°C	120°C/72°C	All Temperature ranges
		h_{ef}	$N_{Rk,b} = N_{Rk,p}$			$N_{Rk,b} = N_{Rk,p}$			$V_{Rk,b}$ [2)]
		[mm]	[kN]						
Compressive strength $f_b \geq 20$ N/mm² [1)]									
M8	-	≥ 80	7,0	6,0	6,0	7,0	6,0	6,0	8,0
M10 / HR-M6	-	≥ 90	7,0	6,0	6,0	7,0	6,0	6,0	8,0
M12 / HR-M8	-	≥ 100	7,0	6,0	6,0	7,0	6,0	6,0	8,0
M16 / HR-M10	-	≥ 100	8,0	6,5	6,5	8,0	6,5	6,5	12,0
M8	12x80	80	7,0	6,0	6,0	7,0	6,0	6,0	8,0
M8 / M10/ HR-M6	16x85	85	7,0	6,0	6,0	7,0	6,0	6,0	8,0
	16x130	130	7,0	6,0	6,0	7,0	6,0	6,0	8,0
M12 / HR-M8	20x85	85	7,0	6,0	6,0	7,0	6,0	6,0	8,0
	20x130	130	7,0	6,0	6,0	7,0	6,0	6,0	8,0
	20x200	200	7,0	6,0	6,0	7,0	6,0	6,0	8,0
M16 / HR-M10	20x85	85	8,0	6,5	6,5	8,0	6,5	6,5	12,0
	20x130	130	8,0	6,5	6,5	8,0	6,5	6,5	12,0
	20x200	200	8,0	6,5	6,5	8,0	6,5	6,5	12,0

1) For lower compressive strengths resistances must be multiplied by the conversion factor according to Table C38. For stones with higher strengths, the shown values are valid without conversion.

2) $V_{Rk,c}$ according to Annex C3

Table C44: Displacements

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

RESINA VINILESTER + SIN ESTIRENO LUSAN

Performances Solid clay brick 1DF
Characteristic Resistances and Displacements

Annex C 16

Brick type: Solid clay brick 2DF

Table C45: Stone description

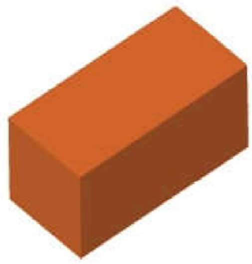
Brick type	Solid clay brick Mz- 2DF	
Density ρ [kg/dm³]	≥ 2,0	
Compressive strength f_b [N/mm²]	≥ 28	
Conversion factor for lower compressive strengths	$(f_b / 28)^{0,5} \leq 1,0$	
Code	EN 771-1	
Producer (Country)	e.g. Wienerberger (DE)	
Brick dimensions [mm]	≥ 240 x 115 x 113	
Drilling method	Hammer drilling	

Table C46: Installation parameter

Anchor size		[-]	M8	M10	M12	M16	HR-M6	HR-M8	HR-M10
Installation torque	T_{inst}	[Nm]	≤ 10	≤ 10	≤ 10	≤ 10	≤ 10	≤ 10	≤ 10
Char. Edge distance	c_{cr}	[mm]	150 (for shear loads perpendicular to the free edge: c_{cr} = 240)						
Minimum Edge Distance	c_{min}	[mm]	50						
Characteristic Spacing	$s_{cr,II}$	[mm]	240						
	$s_{cr,\perp}$	[mm]	240						
Minimum Spacing	s_{min}	[mm]	50						

Table C47: Reduction factors for single anchors at the edge

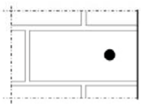
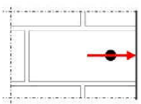
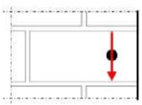
Tension load			Shear load					
			Perpendicular to the free edge			Parallel to the free edge		
	with c ≥	$\alpha_{edge,N}$		with c ≥	$\alpha_{edge,V\perp}$		with c ≥	$\alpha_{edge,VII}$
	50	1,00		50	0,20		50	1,00
				125	0,50			
	150	1,00		240	1,00		150	1,00

Table C48: Factors for anchor groups under tension load

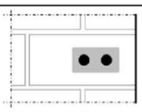
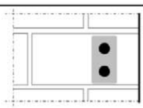
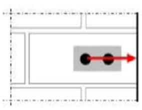
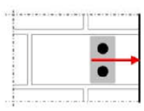
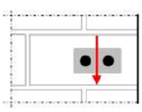
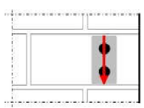
Anchor position parallel to hor. joint				Anchor position perpendicular to hor. joint			
	with c ≥	with s ≥	$\alpha_{g\,II,N}$		with c ≥	with s ≥	$\alpha_{g\perp,N}$
	50	50	1,50		50	50	0,80
	150	240	2,00		150	240	2,00

Table C49: Factors for anchor groups under shear load

	Anchor position parallel to hor. joint				Anchor position perpendicular to hor. joint			
Shear load perpendicular to the free edge		with c ≥	with s ≥	$\alpha_{g\,II,V\perp}$		with c ≥	with s ≥	$\alpha_{g\perp,V\perp}$
		50	50	0,40		50	50	0,20
		240	50	1,20		240	50	0,60
		240	240	2,00		240	125	1,00
						240	240	2,00
Shear load parallel to the free edge		with c ≥	with s ≥	$\alpha_{g\,II,VII}$		with c ≥	with s ≥	$\alpha_{g\perp,VII}$
		50	50	1,20		50	50	1,00
		150	240	2,00		50	125	1,00
						150	240	2,00

RESINA VINILESTER + SIN ESTIRENO LUSAN

Performances Solid clay brick 2DF
Description of the stone, Installation parameters, Reduction- and Group factors

Annex C 17

Brick type: Solid clay brick 2DF

Table C50: Characteristic values of tension and shear load resistances

Anchor size	Perforated sleeve	Effective Anchorage depth	Characteristic Resistances with $c \geq c_{cr}$ and $s \geq s_{cr}$						
			Use condition						
			d/d			w/d w/w			d/d w/d w/w
			40°C/24°C	80°C/50°C	120°C/72°C	40°C/24°C	80°C/50°C	120°C/72°C	All Temperature ranges
		h_{ef}	$N_{Rk,b} = N_{Rk,p}$			$N_{Rk,b} = N_{Rk,p}$			$V_{Rk,b}$ [2)]
		[mm]	[kN]						
Compressive strength $f_b \geq 28$ N/mm² [1)]									
M8	-	≥ 80	9,0	9,0	7,5	9,0	9,0	7,5	9,5
M10 / HR-M6	-	≥ 90	9,0	9,0	7,5	9,0	9,0	7,5	9,5
M12 / HR-M8	-	≥ 100	9,0	9,0	7,5	9,0	9,0	7,5	12
M16 / HR-M10	-	≥ 100	9,0	9,0	7,5	9,0	9,0	7,5	12 [3)]
M8	12x80	80	9,0	9,0	7,5	9,0	9,0	7,5	9,5
M8 / M10/ HR-M6	16x85	85	9,0	9,0	7,5	9,0	9,0	7,5	9,5
	16x130	130	9,0	9,0	7,5	9,0	9,0	7,5	9,5
M12 / HR-M8	20x85	85	9,0	9,0	7,5	9,0	9,0	7,5	12
	20x130	130	9,0	9,0	7,5	9,0	9,0	7,5	12
	20x200	200	9,0	9,0	7,5	9,0	9,0	7,5	12
M16 / HR-M10	20x85	85	9,0	9,0	7,5	9,0	9,0	7,5	12 [3)]
	20x130	130	9,0	9,0	7,5	9,0	9,0	7,5	12 [3)]
	20x200	200	9,0	9,0	7,5	9,0	9,0	7,5	12 [3)]

1) For lower compressive strengths resistances must be multiplied by the conversion factor according to Table C37. For stones with higher strengths, the shown values are valid without conversion.
2) $V_{Rk,c}$ according to Annex C3
3) Valid for all stone strengths with min. 10 N/mm²

Table C51: Displacements

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

RESINA VINILESTER + SIN ESTIRENO LUSAN

Performances Solid clay brick 2DF
Characteristic Resistances and Displacements

Annex C 18

Brick type: Hollow clay brick 10 DF

Table C52: Stone description

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

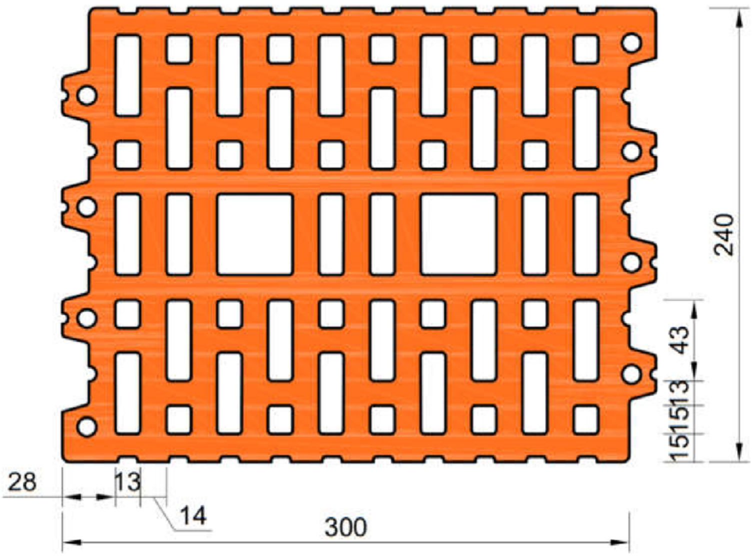
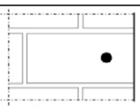
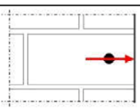
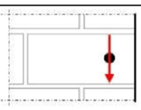


Table C53: Installation parameter

Anchor size		[-]	M8	M10	M12	M16	HR-M6	HR-M8	HR-M10
Installation torque	T_{inst}	[Nm]	≤ 5	≤ 10	≤ 10	≤ 10	≤ 5	≤ 5	≤ 10
Char. Edge distance	c_{cr}	[mm]	120 (for shear loads perpendicular to the free edge: c_{cr} = 300)						
Minimum Edge Distance	c_{min}	[mm]	50						
Characteristic Spacing	$s_{cr,II}$	[mm]	300						
	$s_{cr,\perp}$	[mm]	250						
Minimum Spacing	s_{min}	[mm]	50						

Table C54: Reduction factors for single anchors at the edge

Tension load			Shear load					
			Perpendicular to the free edge			Parallel to the free edge		
	with c ≥	$\alpha_{edge,N}$		with c ≥	$\alpha_{edge,V\perp}$		with c ≥	$\alpha_{edge,VII}$
	50	1,00		50	0,20		50	1,00
	120	1,00		300	1,00		120	1,00

RESINA VINILESTER + SIN ESTIRENO LUSAN

Performances Hollow clay brick HLZ 10DF
Description of the stone, Installation parameters, Reductionfactors

Annex C 19

Brick type: Hollow clay brick 10 DF

Table C55: Factors for anchor groups under tension load

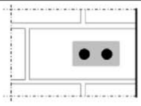
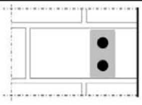
Anchor position parallel to hor. joint				Anchor position perpendicular to hor. joint			
	with c ≥	with s ≥	$\alpha_{g\,II,\,N}$		with c ≥	with s ≥	$\alpha_{g\,\perp,\,N}$
	50	50	1,55		50	50	1,00
	120	300	2,00		120	250	2,00

Table C56: Factors for anchor groups under shear load

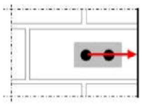
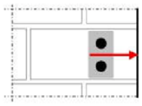
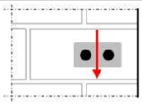
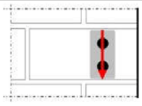
	Anchor position parallel to hor. joint				Anchor position perpendicular to hor. joint			
Shear load perpendicular to the free edge		with c ≥	with s ≥	$\alpha_{g\,II,V\,\perp}$		with c ≥	with s ≥	$\alpha_{g\,\perp,V\,\perp}$
		50	50	0,30		50	50	0,20
		300	50	1,40		300	50	1,00
		300	300	2,00		300	250	2,00
Shear load parallel to the free edge		with c ≥	with s ≥	$\alpha_{g\,II,V\,II}$		with c ≥	with s ≥	$\alpha_{g\,\perp,V\,II}$
		50	50	1,85		50	50	1,00
		120	300	2,00		120	250	2,00

Table C57: Characteristic values of tension and shear load resistances

Anchor size	Perforated sleeve	Effecitve Anchorage depth	Characteristic Resistances with $c \geq c_{cr}$ and $s \geq s_{cr}$						
			Use condition						
			d/d			w/d w/w			d/d w/d w/w
			40°C/24°C	80°C/50°C	120°C/72°C	40°C/24°C	80°C/50°C	120°C/72°C	All Temperature ranges
		h_{ef}	$N_{Rk,b} = N_{Rk,p}$			$N_{Rk,b} = N_{Rk,p}$			$V_{Rk,b}$ 2)
		[mm]	[kN]						
Compressive strength $f_b \geq 20$ N/mm² 1)									
M8	12x80	80	2,5	2,5	2,0	2,5	2,5	2,0	8,0
M8 / M10/ HR-M6	16x85	85	2,5	2,5	2,0	2,5	2,5	2,0	8,0
	16x130	130	2,5	2,5	2,0	2,5	2,5	2,0	8,0
M12 / HR-M8	20x85	85	5,0	5,0	4,5	5,0	5,0	4,5	8,0
	20x130	130	5,0	5,0	4,5	5,0	5,0	4,5	8,0
	20x200	200	5,0	5,0	4,5	5,0	5,0	4,5	8,0
M16 / HR-M10	20x85	85	5,0	5,0	4,5	5,0	5,0	4,5	11,5
	20x130	130	5,0	5,0	4,5	5,0	5,0	4,5	11,5
	20x200	200	5,0	5,0	4,5	5,0	5,0	4,5	11,5

1) For lower compressive strengths resistances must be multiplied by the conversion factor according to Table C52. For stones with higher strengths, the shown values are valid without conversion.
2) $V_{Rk,c}$ according to Annex C3

Table C58: Displacements

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

RESINA VINILESTER + SIN ESTIRENO LUSAN

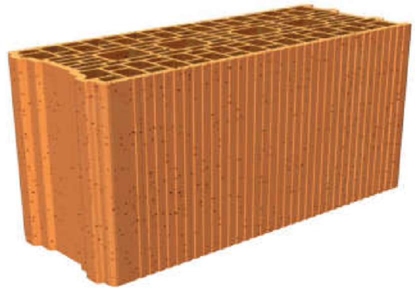
Performances Hollow clay brick HLZ 10DF
Group factors, characteristic Resistances and Displacements

Annex C 20

Brick type: Hollow Clay brick Porotherm Homebric

Table C59: Stone description

Brick type		Hollow clay brick Porotherm Homebric
Density	ρ [kg/dm³]	≥ 0,70
Compressive strength	f_b [N/mm²]	≥ 10
Conversion factor for lower compressive strengths		$(f_b / 10)^{0,5} \leq 1,0$
Code		EN 771-1
Producer (Country)		e.g. Wienerberger (FR)
Brick dimensions	[mm]	500 x 200 x 300
Drilling method		Rotary drilling



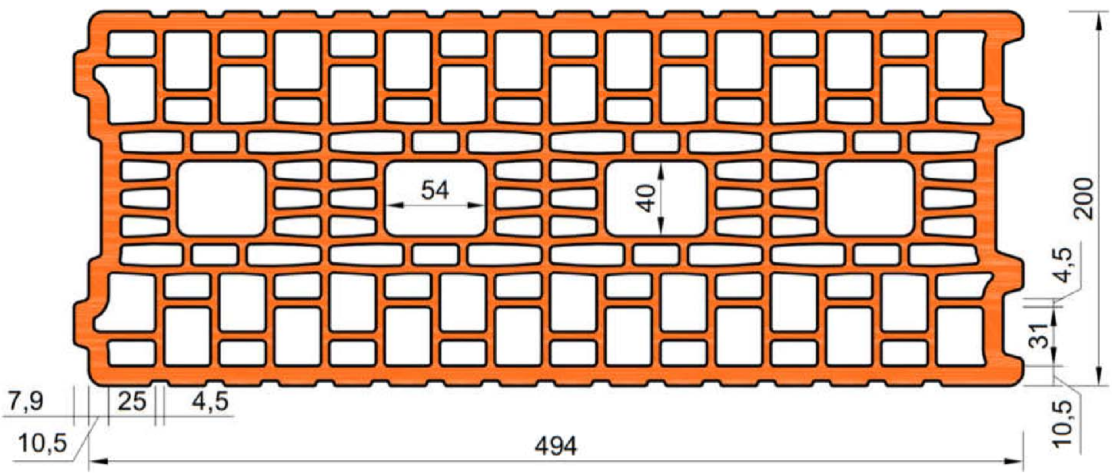
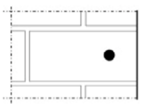
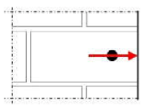
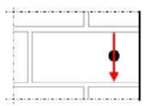


Table C60: Installation parameter

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

Table C61: Reduction factors for single anchors at the edge

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

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Performances Hollow clay brick Porotherm Homebric
Description of the stone, Installation parameters, Reductionfactors

Annex C 21

Brick type: Hollow Clay brick Porotherm Homebric

Table C62: Factors for anchor groups under tension load

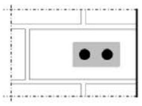
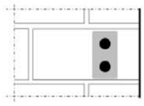
Anchor position parallel to hor. joint				Anchor position perpendicular to hor. joint			
	with c ≥	with s ≥	$\alpha_{g\,II,\,N}$		with c ≥	with s ≥	$\alpha_{g\,\perp,\,N}$
	120	100	1,00		120	100	1,00
	200	100	2,00		200	100	1,20
	120	500	2,00		120	300	2,00

Table C63: Factors for anchor groups under shear load

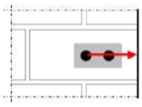
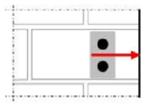
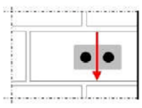
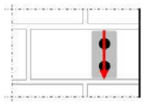
	Anchor position parallel to hor. joint				Anchor position perpendicular to hor. joint			
Shear load perpendicular to the free edge		with c ≥	with s ≥	$\alpha_{g\,II,V\perp}$		with c ≥	with s ≥	$\alpha_{g\,\perp,V\perp}$
		120	100	0,30		120	100	0,30
		250	100	0,60		250	100	0,60
		500	100	1,00		120	300	2,00
		120	500	2,00				
Shear load parallel to the free edge		with c ≥	with s ≥	$\alpha_{g\,II,V\,II}$		with c ≥	with s ≥	$\alpha_{g\,\perp,V\,II}$
		120	100	1,00		120	100	1,00
		120	500	2,00		120	300	2,00

Table C64: Characteristic values of tension and shear load resistances

Anchor size	Perforated sleeve	Effecitve Anchorage depth	Characteristic Resistances with $c \geq c_{cr}$ and $s \geq s_{cr}$						
			Use condition						
			d/d			w/d w/w			d/d w/d w/w
			40°C/24°C	80°C/50°C	120°C/72°C	40°C/24°C	80°C/50°C	120°C/72°C	All Temperature ranges
		h_{ef}	$N_{Rk,b} = N_{Rk,p}$			$N_{Rk,b} = N_{Rk,p}$			$V_{Rk,b}$ [2)]
		[mm]	[kN]						
Compressive strength $f_b \geq 10$ N/mm² [1)]									
M8	12x80	80	1,2						3,0
M8 / M10/ HR-M6	16x85	85	1,2						3,0
	16x130	130	1,5						3,5
M12 / M16/ HR-M8 / HR-M10	20x85	85	1,2						4,0
	20x130	130	1,5						4,0
	20x200	200	1,5						4,0

1) For lower compressive strengths resistances must be multiplied by the conversion factor according to Table C59. For stones with higher strengths, the shown values are valid without conversion.
2) $V_{Rk,c}$ according to Annex C3

Table C65: Displacements

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

RESINA VINILESTER + SIN ESTIRENO LUSAN

Performances Hollow clay brick Porotherm Homebric
Group factors, characteristic Resistances and Displacements

Annex C 22

Brick type: Hollow Clay brick BGV Thermo

Table C66: Stone description

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

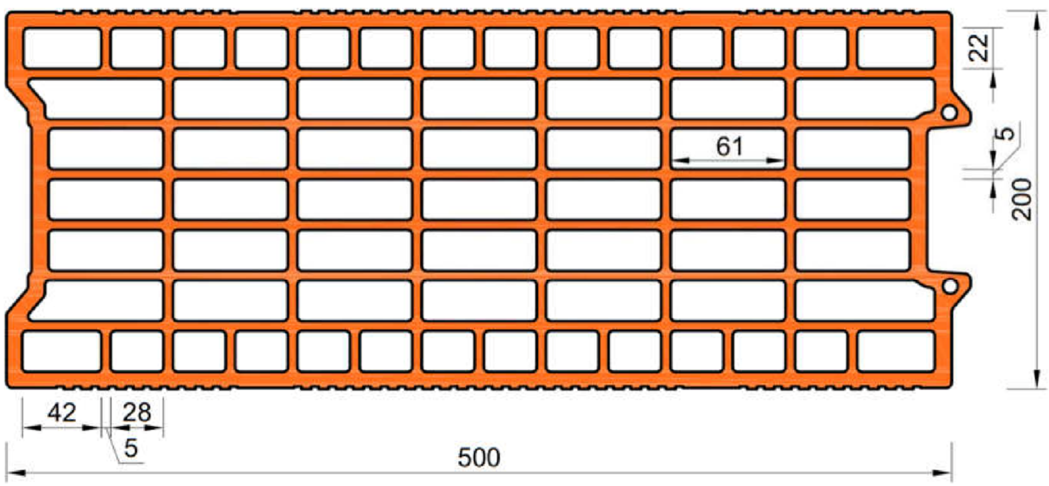
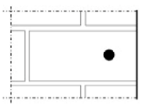
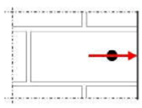
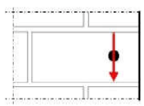


Table C67: Installation parameter

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

Table C68: Reduction factors for single anchors at the edge

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

RESINA VINILESTER + SIN ESTIRENO LUSAN

Performances Hollow clay brick BGV Thermo
Description of the stone, Installation parameters, Reductionfactors

Annex C 23

Brick type: Hollow Clay brick BGV Thermo

Table C69: Factors for anchor groups under tension load

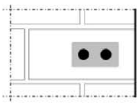
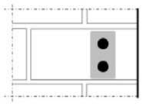
Anchor position parallel to hor. joint				Anchor position perpendicular to hor. joint			
	with c ≥	with s ≥	$\alpha_{g\,II,\,N}$		with c ≥	with s ≥	$\alpha_{g\,\perp,\,N}$
	120	100	1,00		120	100	1,00
	200	100	1,70		200	100	1,10
	120	500	2,00		120	315	2,00

Table C70: Factors for anchor groups under shear load

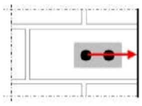
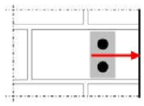
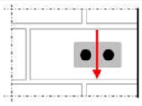
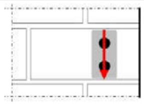
	Anchor position parallel to hor. joint				Anchor position perpendicular to hor. joint			
Shear load perpendicular to the free edge		with c ≥	with s ≥	$\alpha_{g\,II,V\perp}$		with c ≥	with s ≥	$\alpha_{g\,\perp,V\perp}$
		120	100	1,00		120	100	1,00
		120	500	2,00		120	315	2,00
Shear load parallel to the free edge		with c ≥	with s ≥	$\alpha_{g\,II,V\,II}$		with c ≥	with s ≥	$\alpha_{g\,\perp,V\,II}$
		120	100	1,00		120	100	1,00
		120	500	2,00		120	315	2,00

Table C71: Characteristic values of tension and shear load resistances

Anchor size	Perforated sleeve	Effecitve Anchorage depth	Characteristic Resistances with c ≥ c_{cr} and s ≥ s_{cr}						
			Use condition						
			d/d			w/d w/w			d/d w/d w/w
			40°C/24°C	80°C/50°C	120°C/72°C	40°C/24°C	80°C/50°C	120°C/72°C	All Temperature ranges
		h_{ef}	$N_{Rk,b} = N_{Rk,p}$			$N_{Rk,b} = N_{Rk,p}$			$V_{Rk,b}$ [2)]
		[mm]	[kN]						
Compressive strength $f_b \geq 10$ N/mm² [1)]									
M8	12x80	80	0,9						3,5
M8 / M10/ HR-M6	16x85	85	0,9						3,5
	16x130	130	2,0		1,5	2,0		1,5	4,0
M12 / HR-M8	20x85	85	0,9						4,0
	20x130	130	2,0		1,5	2,0		1,5	4,0
	20x200	200	2,0		1,5	2,0		1,5	4,0
M16 / HR-M10	20x85	85	0,9						4,0
	20x130	130	2,0		1,5	2,0		1,5	4,0
	20x200	200	2,0		1,5	2,0		1,5	4,0

1) For lower compressive strengths resistances must be multiplied by the conversion factor according to Table C66. For stones with higher strengths, the shown values are valid without conversion.

2) $V_{Rk,c}$ according to Annex C3

Table C72: Displacements

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

RESINA VINILESTER + SIN ESTIRENO LUSAN

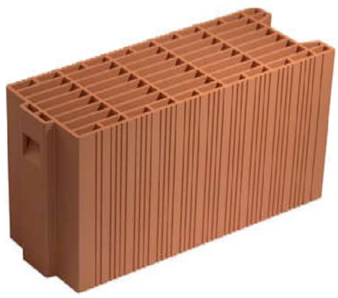
Performances Hollow clay brick BGV Thermo
Group factors, characteristic Resistances and Displacements

Annex C 24

Brick type: Hollow Clay brick Calibric R+

Table C73: Stone description

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



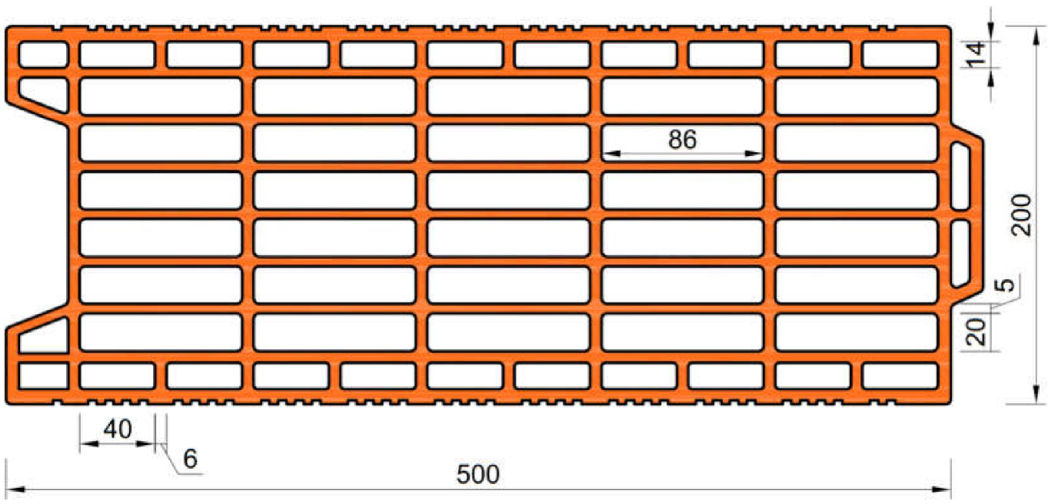
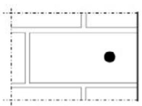
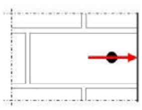
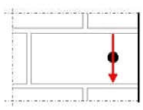


Table C74: Installation parameter

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

Table C75: Reduction factors for single anchors at the edge

<table>
<tr><th colspan="3" rowspan="2">Tension load</th><th colspan="6">Shear load</th></tr>
<tr><th colspan="3">Perpendicular to the free edge</th><th colspan="3">Parallel to the free edge</th></tr>
<tr><td rowspan="3"></td><td>with c ≥</td><td>$\alpha_{edge, N}$</td><td rowspan="3"></td><td>with c ≥</td><td>$\alpha_{edge, V\perp}$</td><td rowspan="3"></td><td>with c ≥</td><td>$\alpha_{edge, V II}$</td></tr>
<tr><td>120</td><td>1,00</td><td>120
250</td><td>0,15
0,30</td><td>120</td><td>0,30</td></tr>
<tr><td>120</td><td>1,00</td><td>500</td><td>1,00</td><td>250</td><td>1,00</td></tr>
</table>

RESINA VINILESTER + SIN ESTIRENO LUSAN

Performances Hollow clay brick Calibric R+
Description of the stone, Installation parameters, Reductionfactors

Annex C 25

Brick type: Hollow Clay brick Calibric R+

Table C76: Factors for anchor groups under tension load

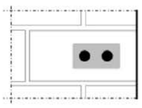
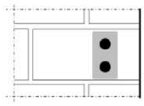
Anchor position parallel to hor. joint				Anchor position perpendicular to hor. joint			
	with c ≥	with s ≥	$\alpha_{g\,II,\,N}$		with c ≥	with s ≥	$\alpha_{g\,\perp,\,N}$
	120	100	1,00		120	100	1,00
	175	100	1,70		175	100	1,10
	120	500	2,00		120	315	2,00

Table C77: Factors for anchor groups under shear load

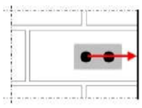
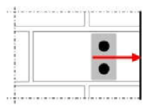
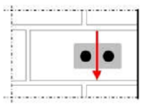
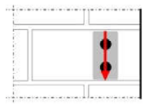
	Anchor position parallel to hor. joint				Anchor position perpendicular to hor. joint			
Shear load perpendicular to the free edge		with c ≥	with s ≥	$\alpha_{g\,II,V\perp}$		with c ≥	with s ≥	$\alpha_{g\,\perp,V\perp}$
		120	100	1,00		120	100	1,00
		120	500	2,00		120	315	2,00
Shear load parallel to the free edge		with c ≥	with s ≥	$\alpha_{g\,II,V\,II}$		with c ≥	with s ≥	$\alpha_{g\,\perp,V\,II}$
		120	100	1,00		120	100	1,00
		120	500	2,00		120	315	2,00

Table C78: Characteristic values of tension and shear load resistances

Anchor size	Perforated sleeve	Effective Anchorage depth	Characteristic Resistances with $c \geq c_{cr}$ and $s \geq s_{cr}$						
			Use condition						
			d/d			w/d w/w			d/d w/d w/w
			40°C/24°C	80°C/50°C	120°C/72°C	40°C/24°C	80°C/50°C	120°C/72°C	All Temperature ranges
		h_{ef}	$N_{Rk,b} = N_{Rk,p}$			$N_{Rk,b} = N_{Rk,p}$			$V_{Rk,b}$ 2)
		[mm]	[kN]						
Compressive strength $f_b \geq 12$ N/mm² 1)									
M8	12x80	80	1,2	1,2	0,9	1,2	1,2	0,9	4,0
M8 / M10/ HR-M6	16x85	85	1,2	1,2	0,9	1,2	1,2	0,9	5,5
	16x130	130	1,5	1,5	1,2	1,5	1,5	1,2	5,5
M12 / HR-M8	20x85	85	1,2	1,2	0,9	1,2	1,2	0,9	8,5
	20x130	130	1,5	1,5	1,2	1,5	1,5	1,2	8,5
M16 / HR-M10	20x85	85	1,2	1,2	0,9	1,2	1,2	0,9	8,5
	20x130	130	1,5	1,5	1,2	1,5	1,5	1,2	8,5

1) For lower compressive strengths resistances must be multiplied by the conversion factor according to Table C73. For stones with higher strengths, the shown values are valid without conversion.
2) $V_{Rk,c}$ according to Annex C3

Table C79: Displacements

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

RESINA VINILESTER + SIN ESTIRENO LUSAN

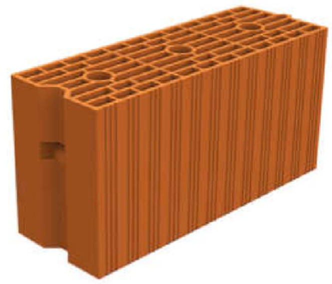
Performances Hollow Clay brick Calibric R+
Group factors, characteristic Resistances and Displacements

Annex C 26

Brick type: Hollow Clay brick Urbanbric

Table C80: Stone description

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



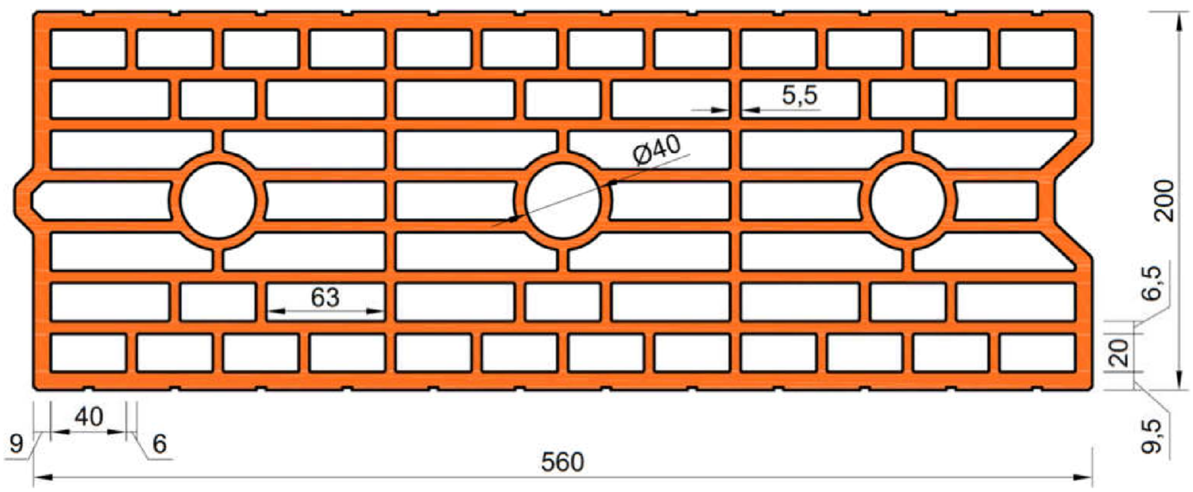
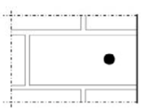
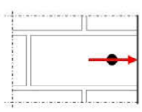
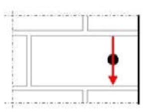


Table C81: Installation parameter

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

Table C82: Reduction factors for single anchors at the edge

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

RESINA VINILESTER + SIN ESTIRENO LUSAN	**Annex C 27**
Performances Hollow clay brick Urbanbric Description of the stone, Installation parameters, Reductionfactors	

Brick type: Hollow Clay brick Urbanbric

Table C83: Factors for anchor groups under tension load

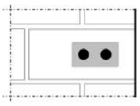
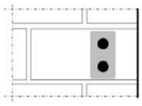
Anchor position parallel to hor. joint				Anchor position perpendicular to hor. joint			
	with c ≥	with s ≥	$\alpha_{g\,II,\,N}$		with c ≥	with s ≥	$\alpha_{g\,\perp,\,N}$
	120	100	1,00		120	100	1,00
	185	100	1,90		185	100	1,10
	120	560	2,00		120	275	2,00

Table C84: Factors for anchor groups under shear load

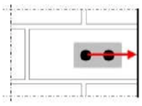
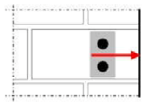
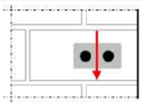
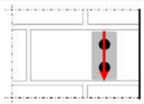
	Anchor position parallel to hor. joint				Anchor position perpendicular to hor. joint			
Shear load perpendicular to the free edge		with c ≥	with s ≥	$\alpha_{g\,II,V\perp}$		with c ≥	with s ≥	$\alpha_{g\,\perp,V\perp}$
		120	100	1,00		120	100	1,00
		120	560	2,00		120	275	2,00
Shear load parallel to the free edge		with c ≥	with s ≥	$\alpha_{g\,II,V\,II}$		with c ≥	with s ≥	$\alpha_{g\,\perp,V\,II}$
		120	100	1,00		120	100	1,00
		120	560	2,00		120	275	2,00

Table C85: Characteristic values of tension and shear load resistances

Anchor size	Perforated sleeve	Effecitve Anchorage depth	Characteristic Resistances with $c \geq c_{cr}$ and $s \geq s_{cr}$						
			Use condition						
			d/d			w/d w/w			d/d w/d w/w
			40°C/24°C	80°C/50°C	120°C/72°C	40°C/24°C	80°C/50°C	120°C/72°C	All Temperature ranges
		h_{ef}	$N_{Rk,b} = N_{Rk,p}$			$N_{Rk,b} = N_{Rk,p}$			$V_{Rk,b}$ 2)
		[mm]	[kN]						
Compressive strength $f_b \geq 12$ N/mm² 1)									
M8	12x80	80	1,2	1,2	0,9	1,2	1,2	0,9	4,5
M8 / M10/ HR-M6	16x85	85	1,2	1,2	0,9	1,2	1,2	0,9	4,5
	16x130	130	3,0	3,0	2,5	3,0	3,0	2,5	4,5
M12 / HR-M8	20x85	85	1,2	1,2	0,9	1,2	1,2	0,9	5,0
	20x130	130	3,0	3,0	2,5	3,0	3,0	2,5	5,0
M16 / HR-M10	20x85	85	1,2	1,2	0,9	1,2	1,2	0,9	5,0
	20x130	130	3,0	3,0	2,5	3,0	3,0	2,5	5,0

1) For lower compressive strengths resistances must be multiplied by the conversion factor according to Table C80. For stones with higher strengths, the shown values are valid without conversion.
2) $V_{Rk,c}$ according to Annex C3

Table C86: Displacements

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

RESINA VINILESTER + SIN ESTIRENO LUSAN

Performances Hollow Clay brick Urbanbric
Group factors, characteristic Resistances and Displacements

Annex C 28

Brick type: Hollow Clay brick Brique creuse C40

Table C87: Stone description

Brick type		Hollow clay brick Brique creuse C40	
Density	ρ [kg/dm³]	≥ 0,70	
Compressive strength	f_b [N/mm²]	≥ 12	
Conversion factor for lower compressive strengths		$(f_b / 12)^{0,5} \leq 1,0$	
Code		EN 771-1	
Producer (Country)		e.g. Terreal (FR)	
Brick dimensions	[mm]	500 x 200 x 200	
Drilling method		Rotary drilling	

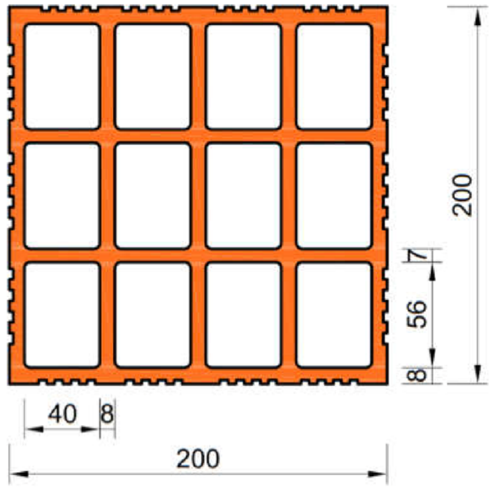
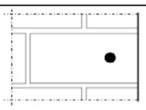
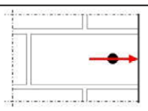
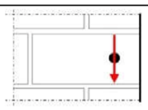


Table C88: Installation parameter

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

Table C89: Reduction factors for single anchors at the edge

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

RESINA VINILESTER + SIN ESTIRENO LUSAN

Performances Hollow clay brick Brique Creuse C40
Description of the stone, Installation parameters, Reductionfactors

Annex C 29

Deutsches Institut für Bautechnik DIBt

Brick type: Hollow Clay brick Brique creuse C40

Table C90: Factors for anchor groups under tension load

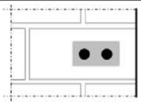
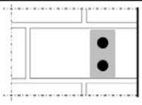
Anchor position parallel to hor. joint				Anchor position perpendicular to hor. joint			
	with c ≥	with s ≥	$\alpha_{g\,II,\,N}$		with c ≥	with s ≥	$\alpha_{g\,\perp,\,N}$
	120	500	2,00		120	200	2,00

Table C91: Factors for anchor groups under shear load

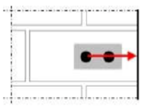
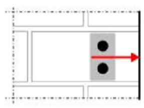
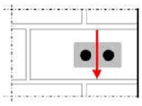
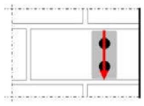
	Anchor position parallel to hor. joint				Anchor position perpendicular to hor. joint			
Shear load perpendicular to the free edge		with c ≥	with s ≥	$\alpha_{g\,II,V\perp}$		with c ≥	with s ≥	$\alpha_{g\,\perp,V\perp}$
		120	500	2,00		120	200	2,00
Shear load parallel to the free edge		with c ≥	with s ≥	$\alpha_{g\,II,V\,II}$		with c ≥	with s ≥	$\alpha_{g\,\perp,V\,II}$
		120	500	2,00		120	200	2,00

Table C92: Characteristic values of tension and shear load resistances

Anchor size	Perforated sleeve	Effecitve Anchorage depth	Characteristic Resistances with $c \geq c_{cr}$ and $s \geq s_{cr}$						
			Use condition						
			d/d			w/d w/w			d/d w/d w/w
			40°C/24°C	80°C/50°C	120°C/72°C	40°C/24°C	80°C/50°C	120°C/72°C	All Temperature ranges
		h_{ef}	$N_{Rk,b} = N_{Rk,p}$			$N_{Rk,b} = N_{Rk,p}$			$V_{Rk,b}$ 2)
		[mm]	[kN]						
Compressive strength $f_b \geq 12$ N/mm² 1)									
M8	12x80	80	1,2	1,2	0,9	1,2	1,2	0,9	1,5
M8 / M10/ HR-M6	16x85	85							
	16x130	130							
M12 / HR-M8	20x85	85							
	20x130	130							
M16 / HR-M10	20x85	85							
	20x130	130							

1) For lower compressive strengths resistances must be multiplied by the conversion factor according to Table C87. For stones with higher strengths, the shown values are valid without conversion.
2) $V_{Rk,c}$ according to Annex C3

Table C93: Displacements

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

RESINA VINILESTER + SIN ESTIRENO LUSAN

Performances Hollow Clay brick Brique Creuse C40
Group factors, characteristic Resistances and Displacements

Annex C 30

Brick type: Hollow Clay brick Blocchi Leggeri

Table C94: Stone description

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

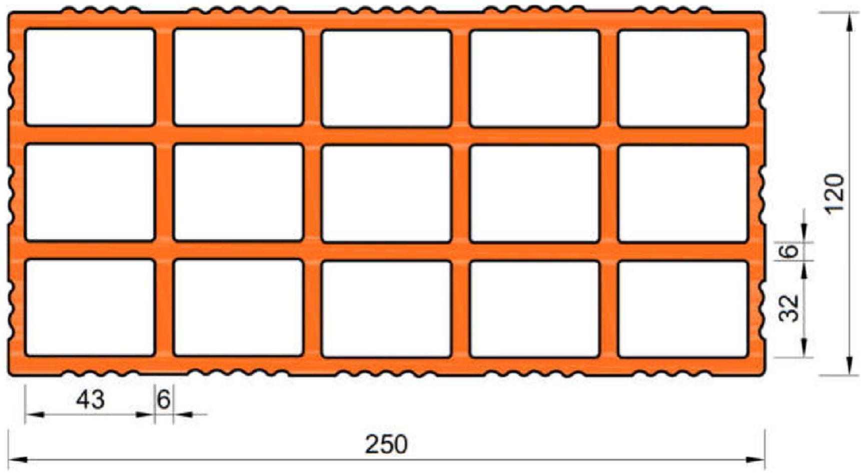
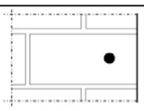
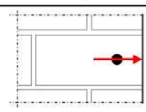
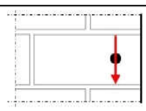


Table C95: Installation parameter

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

Table C96: Reduction factors for single anchors at the edge

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

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Brick type: Hollow Clay brick Blocchi Leggeri

Table C97: Factors for anchor groups under tension load

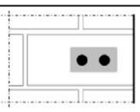
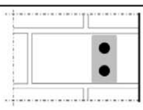
Anchor position parallel to hor. joint				Anchor position perpendicular to hor. joint			
	with c ≥	with s ≥	$\alpha_{g\ II,\ N}$		with c ≥	with s ≥	$\alpha_{g\ \perp,\ N}$
	60	100	1,00		60	100	2,00
	120	250	2,00		120	250	2,00

Table C98: Factors for anchor groups under shear load

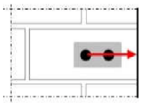
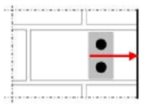
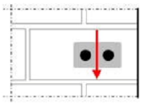
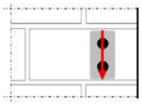
	Anchor position parallel to hor. joint				Anchor position perpendicular to hor. joint			
Shear load perpendicular to the free edge		with c ≥	with s ≥	$\alpha_{g\ II,V\perp}$		with c ≥	with s ≥	$\alpha_{g\ \perp,V\perp}$
		60	100	0,40		60	100	0,40
		250	100	1,00		250	100	1,00
		250	250	2,00		250	250	2,00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

Table C99: Characteristic values of tension and shear load resistances

Anchor size	Perforated sleeve	Effective Anchorage depth	Characteristic Resistances with $c \geq c_{cr}$ and $s \geq s_{cr}$						
			Use condition						
			d/d			w/d w/w			d/d w/d w/w
			40°C/24°C	80°C/50°C	120°C/72°C	40°C/24°C	80°C/50°C	120°C/72°C	All Temperature ranges
		h_{ef}	$N_{Rk,b} = N_{Rk,p}$			$N_{Rk,b} = N_{Rk,p}$			$V_{Rk,b}$ [2)]
		[mm]	[kN]						
Compressive strength $f_b \geq 12$ N/mm² [1)]									
M8	12x80	80	0,6	0,6	0,6	0,6	0,6	0,6	3,5
M8 / M10/ HR-M6	16x85	85							
	16x130	130							
M12 / HR-M8	20x85	85							
	20x130	130							
	20x200	200							
M16 / HR-M10	20x85	85							
	20x130	130							
	20x200	200							

1) For lower compressive strengths resistances must be multiplied by the conversion factor according to Table C94. For stones with higher strengths, the shown values are valid without conversion.
2) $V_{Rk,c}$ according to Annex C3

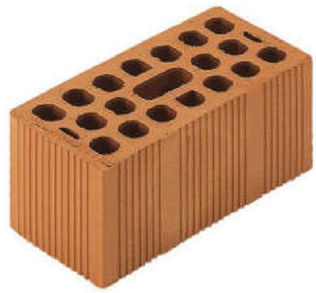
Table C100: Displacements

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

Brick type: Hollow Clay brick Doppio Uni

Table C101: Stone description

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



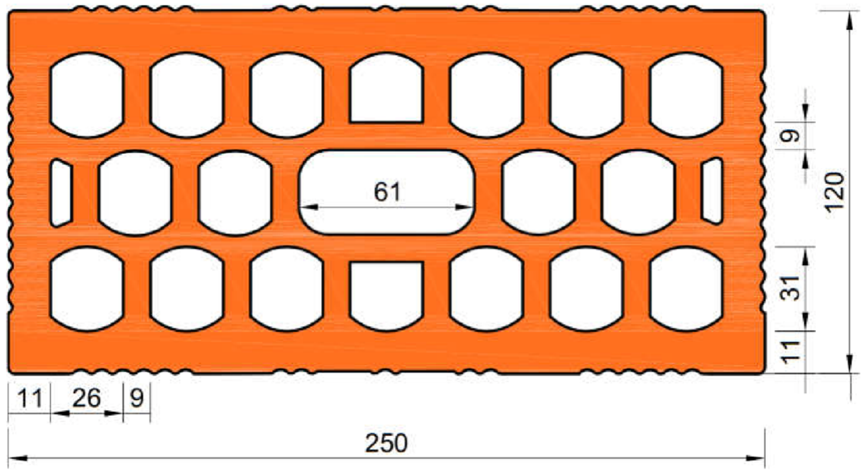
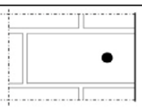
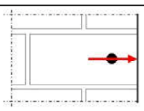
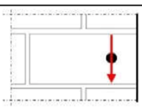


Table C102: Installation parameter

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

Table C103: Reduction factors for single anchors at the edge

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

RESINA VINILESTER + SIN ESTIRENO LUSAN

Performances Hollow clay brick Doppio Uni
Description of the stone, Installation parameters, Reductionfactors

Annex C 33

Brick type: Hollow Clay brick Doppio Uni

Table C104: Factors for anchor groups under tension load

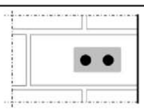
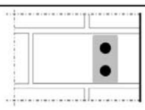
Anchor position parallel to hor. joint				Anchor position perpendicular to hor. joint			
	with c ≥	with s ≥	$\alpha_{g\,II,\,N}$		with c ≥	with s ≥	$\alpha_{g\,\perp,\,N}$
	100	100	1,00		100	120	2,00
	120	250	2,00		120	120	2,00

Table C105: Factors for anchor groups under shear load

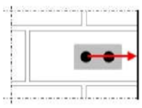
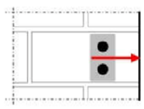
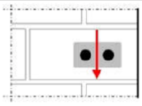
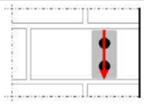
	Anchor position parallel to hor. joint				Anchor position perpendicular to hor. joint			
Shear load perpendicular to the free edge		with c ≥	with s ≥	$\alpha_{g\,II,V\perp}$		with c ≥	with s ≥	$\alpha_{g\,\perp,V\perp}$
		100	100	1,00		100	100	1,00
		250	250	2,00		250	120	2,00
Shear load parallel to the free edge		with c ≥	with s ≥	$\alpha_{g\,II,V\,II}$		with c ≥	with s ≥	$\alpha_{g\,\perp,V\,II}$
		100	100	1,00		100	100	1,00
		120	250	2,00		120	120	2,00

Table C106: Characteristic values of tension and shear load resistances

Anchor size	Perforated sleeve	Effective Anchorage depth	Characteristic Resistances with $c \geq c_{cr}$ and $s \geq s_{cr}$						
			Use condition						
			d/d			w/d w/w			d/d w/d w/w
			40°C/24°C	80°C/50°C	120°C/72°C	40°C/24°C	80°C/50°C	120°C/72°C	All Temperature ranges
		h_{ef}	$N_{Rk,b} = N_{Rk,p}$			$N_{Rk,b} = N_{Rk,p}$			$V_{Rk,b}$ 2)
		[mm]	[kN]						
Compressive strength $f_b \geq 28$ N/mm² 1)									
M8	12x80	80	1,2	1,2	0,9	1,2	1,2	0,9	2,5
M8 / M10/ HR-M6	16x85	85							
	16x130	130							
M12 / HR-M8	20x85	85							
	20x130	130							
	20x200	200							
M16 / HR-M10	20x85	85							
	20x130	130							
	20x200	200							

1) For lower compressive strengths resistances must be multiplied by the conversion factor according to Table C101. For stones with higher strengths, the shown values are valid without conversion.
2) $V_{Rk,c}$ according to Annex C3

Table C107: Displacements

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

Brick type: Hollow light weight concrete brick HBL 16DF

Table C108: Stone description

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

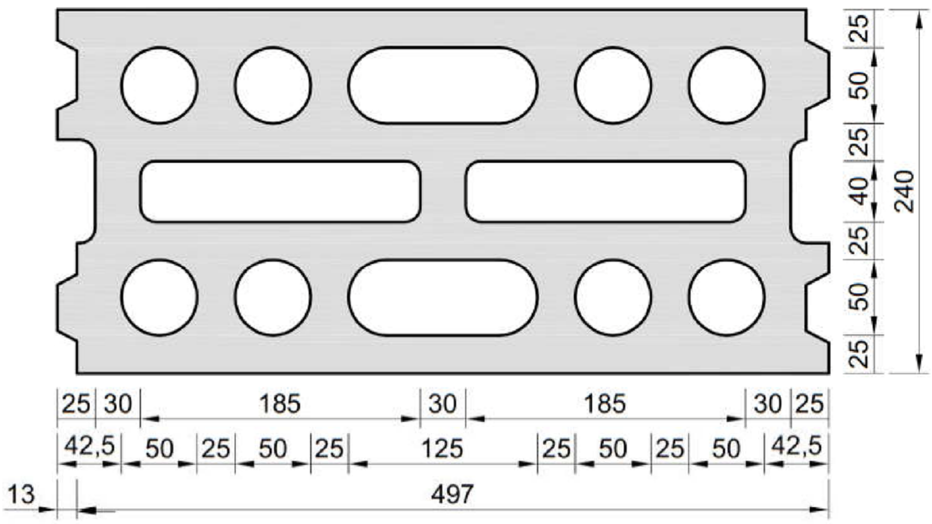
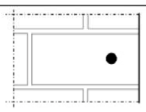
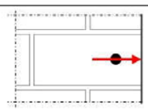
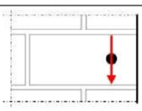


Table C109: Installation parameter

Anchor size		[-]	M8	M10	M12	M16	HR-M6	HR-M8	HR-M10
Installation torque	T_{inst}	[Nm]	≤ 2	≤ 2	≤ 5	≤ 5	≤ 2	≤ 5	≤ 5
Char. Edge distance	c_{cr}	[mm]	120 (for shear loads perpendicular to the free edge: c_{cr} = 250)						
Minimum Edge Distance	c_{min}	[mm]	50						
Characteristic Spacing	$s_{cr,II}$	[mm]	500						
	$s_{cr,\perp}$	[mm]	250						
Minimum Spacing	s_{min}	[mm]	50						

Table C110: Reduction factors for single anchors at the edge

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

RESINA VINILESTER + SIN ESTIRENO LUSAN

Performances Hollow light weight concrete brick HBL 16DF
Description of the stone, Installation parameters, Reductionfactors

Annex C 35

Brick type: Hollow light weight concrete brick HBL 16DF

Table C111: Factors for anchor groups under tension load

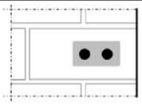
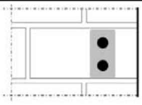
Anchor position parallel to hor. joint				Anchor position perpendicular to hor. joint			
	with c ≥	with s ≥	$\alpha_{g\,II,\,N}$		with c ≥	with s ≥	$\alpha_{g\,\perp,\,N}$
	50	50	2,00		50	50	1,55
	120	500	2,00		120	250	2,00

Table C112: Factors for anchor groups under shear load

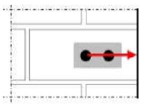
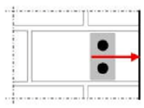
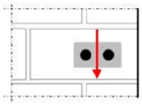
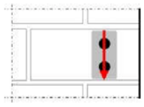
	Anchor position parallel to hor. joint				Anchor position perpendicular to hor. joint			
Shear load perpendicular to the free edge		with c ≥	with s ≥	$\alpha_{g\,II,V\,\perp}$		with c ≥	with s ≥	$\alpha_{g\,\perp,V\,\perp}$
		50	50	0,60		50	50	0,35
		120	50	2,00		120	50	1,15
		120	500	2,00		120	250	2,00
Shear load parallel to the free edge		with c ≥	with s ≥	$\alpha_{g\,II,V\,II}$		with c ≥	with s ≥	$\alpha_{g\,\perp,V\,II}$
		50	50	1,30		50	50	1,00
		120	250	2,00				
		120	500	2,00		120	250	2,00

Table C113: Characteristic values of tension and shear load resistances

Anchor size	Perforated sleeve	Effective Anchorage depth	Characteristic Resistances with $c \geq c_{cr}$ and $s \geq s_{cr}$						
			Use condition						
			d/d			w/d w/w			d/d w/d w/w
			40°C/24°C	80°C/50°C	120°C/72°C	40°C/24°C	80°C/50°C	120°C/72°C	All Temperature ranges
		h_{ef}	$N_{Rk,b} = N_{Rk,p}$			$N_{Rk,b} = N_{Rk,p}$			$V_{Rk,b}$ 2)
		[mm]	[kN]						
Compressive strength $f_b \geq 3{,}1$ N/mm² 1)									
M8 / M10/ HR-M6	16x85	85	1,2	1,2	0,9	1,2	1,2	0,9	2,0
	16x130	130							
M12 / HR-M8	20x85	85	1,5	1,5	1,2	1,5	1,5	1,2	3,0
	20x130	130							
	20x200	200							
M16 / HR-M10	20x85	85							5,0
	20x130	130							
	20x200	200							

1) For lower compressive strengths resistances must be multiplied by the conversion factor according to Table C108. For stones with higher strengths, the shown values are valid without conversion.
2) $V_{Rk,c}$ according to Annex C3

Table C114: Displacements

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

Brick type: Hollow concrete brick Bloc Creux B40

Table C115: Stone description

Brick type		Hollow concrete brick Bloc Creux B40
Density	ρ [kg/dm³]	≥ 0,8
Compressive strength	f_b [N/mm²]	≥ 5,2
Conversion factor for lower compressive strengths		$(f_b / 5,2)^{0,5} \leq 1,0$
Code		EN 772-1
Producer (Country)		e.g. Leroux (FR)
Brick dimensions	[mm]	500 x 200 x 200
Drilling method		Rotary drilling

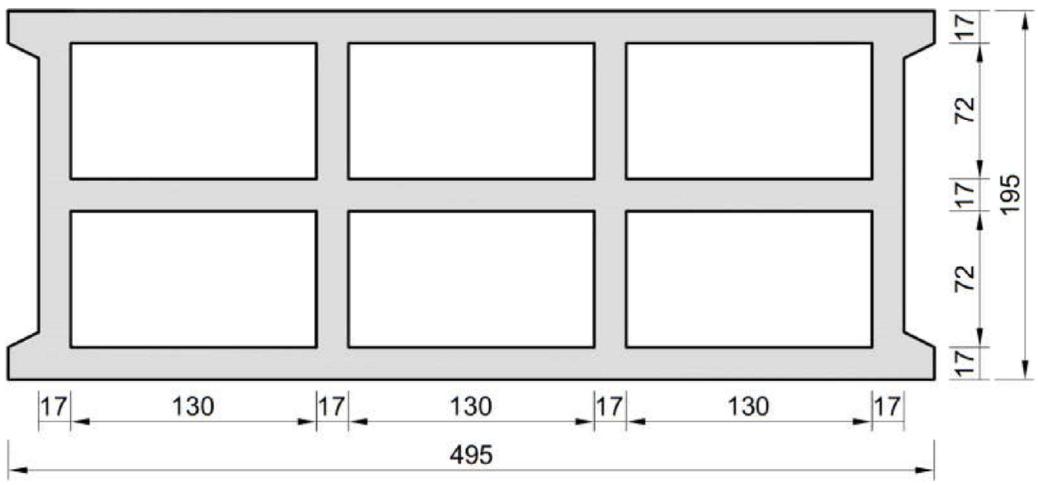
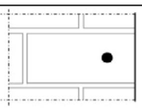
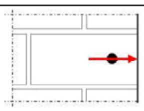
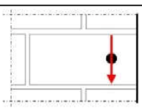


Table C116: Installation parameter

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

Table C117: Reduction factors for single anchors at the edge

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

RESINA VINILESTER + SIN ESTIRENO LUSAN

Performances Hollow concrete brick Bloc Creux B40
Description of the stone, Installation parameters, Reductionfactors

Annex C 37

Brick type: Hollow concrete brick Bloc Creux B40

Table C118: Factors for anchor groups under tension load

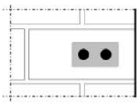
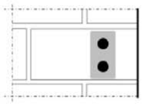
Anchor position parallel to hor. joint				Anchor position perpendicular to hor. joint			
	with c ≥	with s ≥	$\alpha_{g\,II,\,N}$		with c ≥	with s ≥	$\alpha_{g\,\perp,\,N}$
	50	50	1,50		50	50	1,40
	50	170	2,00		50	200	2,00
	120	170	2,00		120	200	2,00

Table C119: Factors for anchor groups under shear load

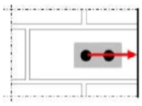
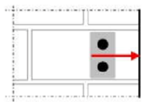
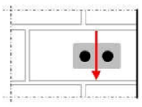
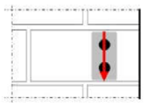
	Anchor position parallel to hor. joint				Anchor position perpendicular to hor. joint			
Shear load perpendicular to the free edge		with c ≥	with s ≥	$\alpha_{g\,II,V\,\perp}$		with c ≥	with s ≥	$\alpha_{g\,\perp,V\,\perp}$
		50	50	0,55		50	50	0,35
		120	50	1,30		120	50	0,85
		120	170	2,00		120	200	2,00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

Table C120: Characteristic values of tension and shear load resistances

Anchor size	Perforated sleeve	Effecitve Anchorage depth	Characteristic Resistances with c ≥ c_{cr} and s ≥ s_{cr}						
			Use condition						
			d/d			w/d w/w			d/d w/d w/w
			40°C/24°C	80°C/50°C	120°C/72°C	40°C/24°C	80°C/50°C	120°C/72°C	All Temperature ranges
		h_{ef}	$N_{Rk,b} = N_{Rk,p}$			$N_{Rk,b} = N_{Rk,p}$			$V_{Rk,b}$ 2)
		[mm]	[kN]						
Compressive strength f_b ≥ 5,2 N/mm² 1)									
M8 / M10/ HR-M6	16x130	130	2,0	1,5	1,2	2,0	1,5	1,2	6,0
M12 / HR-M8	20x130	130							
M16 / HR-M10	20x130	130							

1) For lower compressive strengths resistances must be multiplied by the conversion factor according to Table C115. For stones with higher strengths, the shown values are valid without conversion.
2) $V_{Rk,c}$ according to Annex C3

Table C121: Displacements

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

RESINA VINILESTER + SIN ESTIRENO LUSAN	**Annex C 38**
Performances hollow concrete brick Bloc Creux B40 Group factors, characteristic Resistances and Displacements	

Brick type: Solid light weight concrete brick

Table C122: Stone description

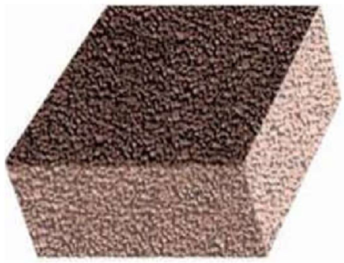
Brick type		Solid light weight concrete brick	
Density	ρ [kg/dm^3]	$\geq$ 0,6	
Compressive strength	f_b [N/mm^2]	$\geq$ 2	
Conversion factor for lower compressive strengths		$(f_b / 2)^{0,5} \leq 1,0$	
Code		EN 771-3	
Producer (Country)		e.g. Bisotherm (DE)	
Brick dimensions	[mm]	$\geq$ 240 x 300 x 113	
Drilling method		Rotary drilling	

Table C123: Installation parameter

Anchor size		[-]	M8	M10	M12	M16	HR-M6	HR-M8	HR-M10
Installation torque	T_{inst}	[Nm]	$\leq$ 2	$\leq$ 2	$\leq$ 2	$\leq$ 2	$\leq$ 2	$\leq$ 2	$\leq$ 2
Char. Edge distance	c_{cr}	[mm]	150						
Minimum Edge Distance	c_{min}	[mm]	60						
Characteristic Spacing	$s_{cr, II}$	[mm]	300						
	$s_{cr, \perp}$	[mm]	300						
Minimum Spacing	s_{min}	[mm]	120						

Table C124: Reduction factors for single anchors at the edge

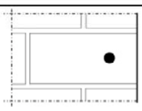
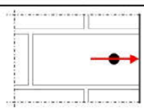
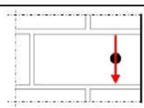
Tension load			Shear load					
			Perpendicular to the free edge			Parallel to the free edge		
	with c $\geq$	$\alpha_{edge, N}$		with c $\geq$	$\alpha_{edge, V \perp}$		with c $\geq$	$\alpha_{edge, V II}$
	60	1,00		60	0,25		60	0,40
	150	1,00		150	1,00		100	1,00

Table C125: Factors for anchor groups under tension load

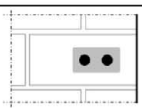
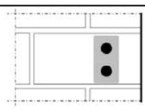
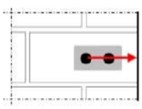
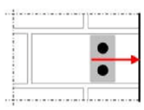
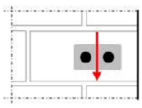
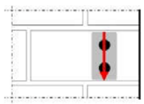
Anchor position parallel to hor. joint				Anchor position perpendicular to hor. joint			
	with c $\geq$	with s $\geq$	$\alpha_{g II, N}$		with c $\geq$	with s $\geq$	$\alpha_{g \perp, N}$
	60	120	1,00		60	120	1,00
	150	300	2,00		150	300	2,00

Table C126: Factors for anchor groups under shear load

	Anchor position parallel to hor. joint				Anchor position perpendicular to hor. joint			
Shear load perpendicular to the free edge		with c $\geq$	with s $\geq$	$\alpha_{g II, V \perp}$		with c $\geq$	with s $\geq$	$\alpha_{g \perp, V \perp}$
		60	120	0,25		60	120	0,25
		150	120	1,00		150	120	1,00
		150	300	2,00		150	300	2,00
Shear load parallel to the free edge		with c $\geq$	with s $\geq$	$\alpha_{g II, V II}$		with c $\geq$	with s $\geq$	$\alpha_{g \perp, V II}$
		60	120	0,40		60	120	0,40
		100	120	1,00		100	120	1,00
		150	300	2,00		150	300	2,00

RESINA VINILESTER + SIN ESTIRENO LUSAN

Performances Solid light weight concrete brick
Description of the stone, Installation parameters, Reduction- and Group factors

Annex C 39

Brick type: Solid light weight concrete brick

Table C127: Characteristic values of tension and shear load resistances

Anchor size	Perforated sleeve	Effective Anchorage depth	Characteristic Resistances with $c \geq c_{cr}$ and $s \geq s_{cr}$						
			Use condition						
			d/d			w/d w/w			d/d w/d w/w
			40°C/24°C	80°C/50°C	120°C/72°C	40°C/24°C	80°C/50°C	120°C/72°C	All Temperature ranges
		h_{ef}	$N_{Rk,b} = N_{Rk,p}$			$N_{Rk,b} = N_{Rk,p}$			$V_{Rk,b}$ [2)]
		[mm]	[kN]						
Compressive strength $f_b \geq 2$ N/mm² [1)]									
M8	-	80	3,0	2,5	2,0	2,5	2,0	1,5	3,0
M10 / HR-M6	-	90							
M12 / HR-M8	-	100							
M16 / HR-M10	-	100							
M8	12x80	80	2,5	2,5	2,0	2,5	2,0	1,5	
M8 / M10/ HR-M6	16x85	85							
	16x130	130							
M12 / HR-M8	20x85	85							
	20x130	130							
	20x200	200							
M16 / HR-M10	20x85	85							
	20x130	130							
	20x200	200							

1) For lower compressive strengths resistances must be multiplied by the conversion factor according to Table C122. For stones with higher strengths, the shown values are valid without conversion.
2) $V_{Rk,c}$ according to Annex C3

Table C128: Displacements

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

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European Technical Assessment

ETA-21/0264 of 4 March 2021

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	RESINA VINILESTER + SIN ESTIRENO LUSAN for rebar connection
Product family to which the construction product belongs	Injection system for post-installed rebar connections
Manufacturer	LUSAN FIJACIONES Y ANCLAJES, S.L. C. / Molinos 20 29491 ALGATOCIN, MALAGA SPANIEN
Manufacturing plant	PLANT 1
This European Technical Assessment contains	21 pages including 3 annexes which form an integral part of this assessment
This European Technical Assessment is issued in accordance with Regulation (EU) No 305/2011, on the basis of	EAD 330087-00-0601, Edition 05/2018

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Specific Part

1 Technical description of the product

The subject of this European Technical Assessment is the post-installed connection, by anchoring or overlap connection joint, of reinforcing bars (rebars) in existing structures made of normal weight concrete, using the "RESINA VINILESTER + SIN ESTIRENO LUSAN for rebar connection" in accordance with the regulations for reinforced concrete construction.

Reinforcing bars made of steel with a diameter ϕ from 8 to 32 mm or the tension anchor ZA from sizes M12 to M24 according to Annex A and injection mortar VINI are used for rebar connections. The rebar is placed into a drilled hole filled with injection mortar and is anchored via the bond between rebar, injection mortar and concrete.

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 rebar connection 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 under static and quasi-static loading	See Annex C 1

3.2 Safety in case of fire (BWR 2)

Essential characteristic	Performance
Reaction to fire	Class A1
Resistance to fire	See Annex C 2 and C 3

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

In accordance with European Assessment Document EAD No. 330087-00-0601, the applicable European legal act is: [96/582/EC].

The system(s) to be applied is (are): 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 with Deutsches Institut für Bautechnik.

Issued in Berlin on 4 March 2021 by Deutsches Institut für Bautechnik

Dipl.-Ing. Beatrix Wittstock
Referatsleiterin

beglaubigt:
Baderschneider

Installation post installed rebar

Figure A1: Overlapping joint for rebar connections of slabs and beams

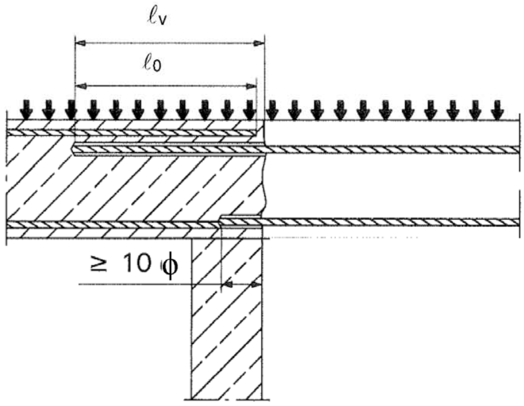


Figure A2: Overlapping joint at a foundation of a wall or column where the rebars are stressed in tension

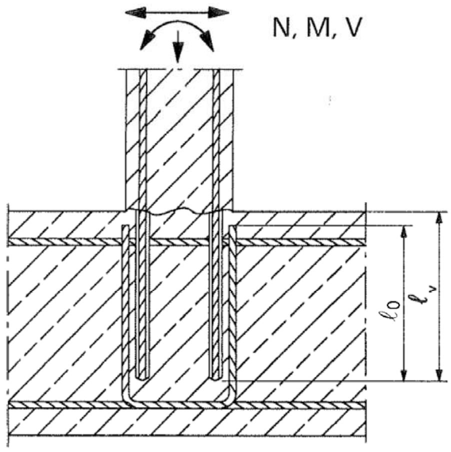


Figure A3: End anchoring of slabs or beams (e.g. designed as simply supported)

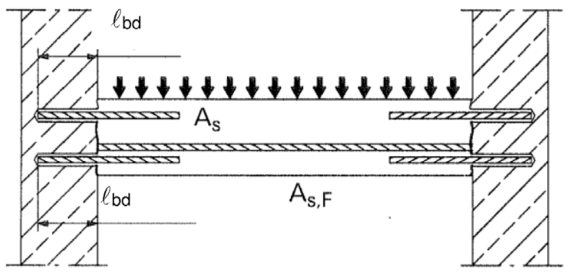


Figure A4: Rebar connection for components stressed primarily in compression. The rebars sre stressed in compression

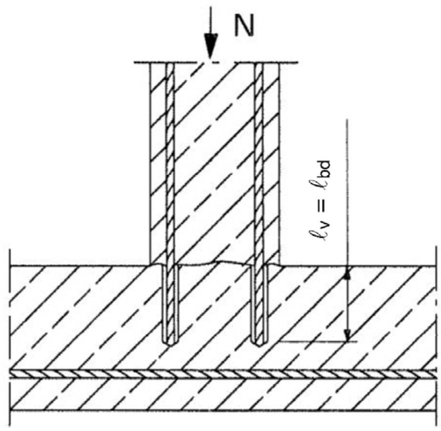
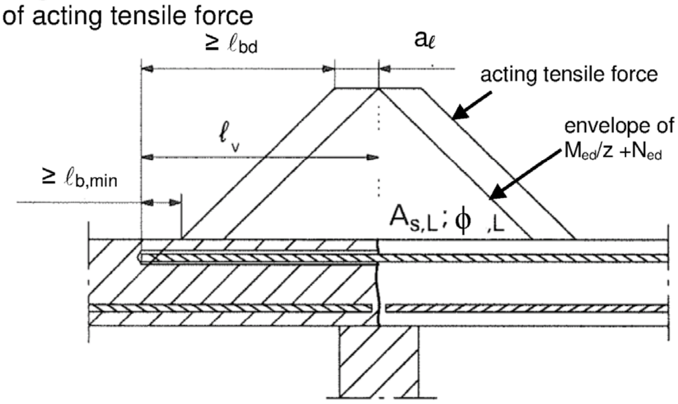


Figure A5: Anchoring of reinforcement to cover the line of acting tensile force



Note to Figure A1 to A5:

In the Figures no transverse reinforcement is plotted, the transverse reinforcement shall comply with EN 1992-1-1:2004+AC:2010.

Preparing of joints according to Annex B 2

Installation tension anchor ZA

Figure A6: Overlapping joint of a column stressed in bending to a foundation

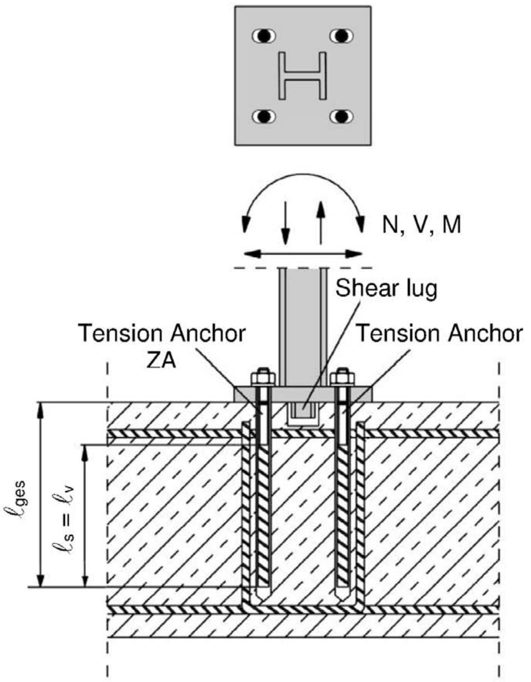


Figure A7: Overlap joint for the anchorage of barrier posts

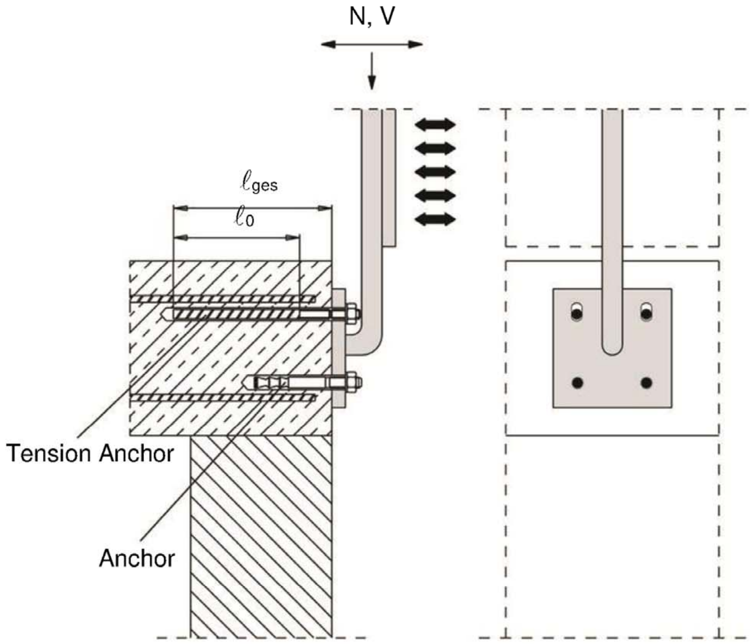
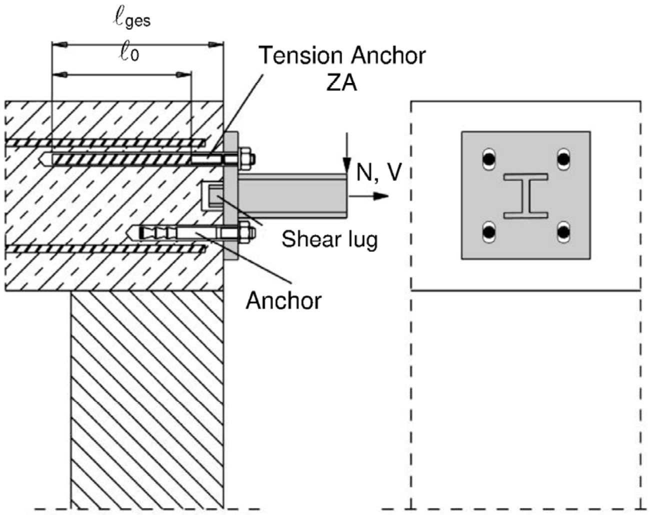


Figure A8: Overlap joint for the anchorage to centilever members



Note to Figure A6 to A8:

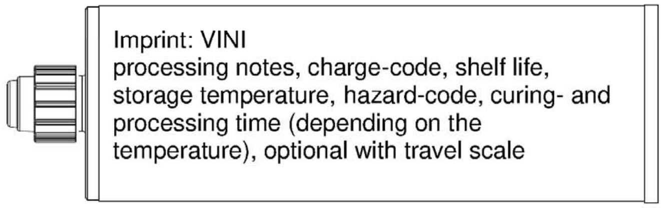
In the Figures no transverse reinforcement is plotted, the transverse reinforcement shall comply with EN 1992-1-1:2002+AC:2010

RESINA VINILESTER + SIN ESTIRENO LUSAN for rebar connection	**Annex A 2**
Product description Installed condition and examples of use for tension anchors ZA	

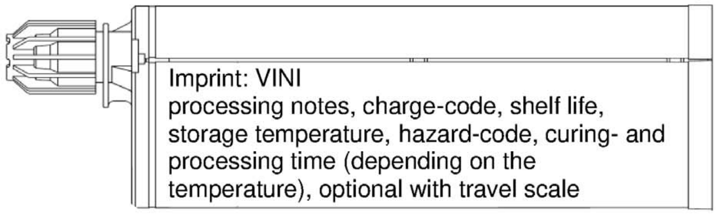
RESINA VINILESTER + SIN ESTIRENO LUSAN:

Injection mortar: VINI

Typ "coaxial": 150 ml, 280 ml, 300 ml up to 333 ml and 380 ml up to 420 ml cartridge



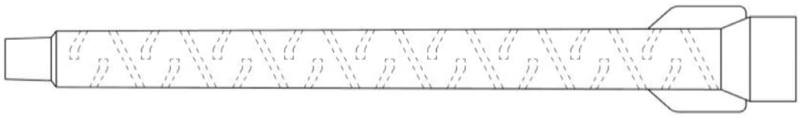
Type "side-by-side": 235 ml, 345 ml and 825 ml cartridge



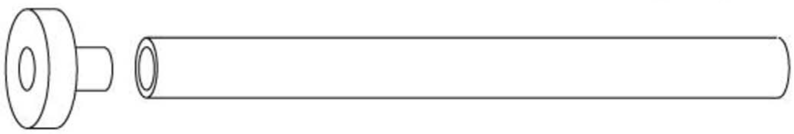
Static Mixer

BO

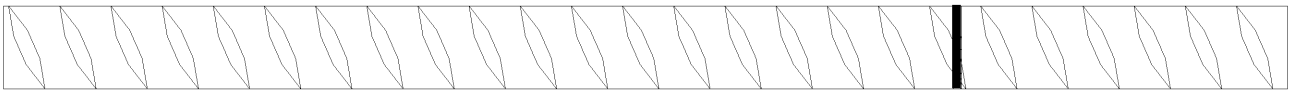
BO



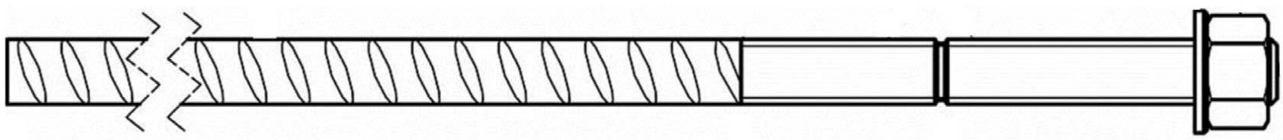
Piston plug VS and mixer extension



Reinforcing bar (rebar): ø8 to ø32

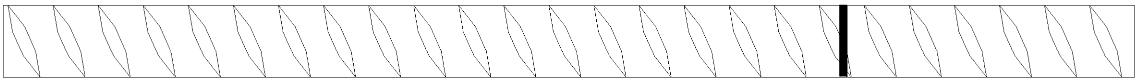


Tension Anchor ZA: M12 to M24



RESINA VINILESTER + SIN ESTIRENO LUSAN for rebar connection	**Annex A 3**
Product description Injection mortar / Static mixer / Rebar / Tension Anchor ZA	

Reinforcing bar (rebar): ø8, ø10, ø12, ø14, ø16, ø20, ø22, ø24, ø25, ø28, ø32



- Minimum value of related rip area $f_{R,min}$ according to EN 1992-1-1:2004+AC:2010
- Rib height of the bar shall be in the range $0{,}05\phi \leq h_{rib} \leq 0{,}07\phi$
  (ϕ: Nominal diameter of the bar; h_{rib}: Rib height of the bar)

Table A1: Materials

Designation	Material
Rebar EN 1992-1-1:2004+AC:2010, Annex C	Bars and de-coiled rods class B or C f_{yk} and k according to NDP or NCL of EN 1992-1-1/NA $f_{uk} = f_{tk} = k \cdot f_{yk}$

RESINA VINILESTER + SIN ESTIRENO LUSAN for rebar connection

Product description
Specifications Rebar

Annex A 4

Tension Anchor ZA: M12, M16, M20, M24

Marking: e.g. ◇ZA 12 A4

◇ Mark of the producer
ZA Trade name
12 Rod diameter/thread
A4 for stainless steel A4
HCR for high corrosion resistance steel

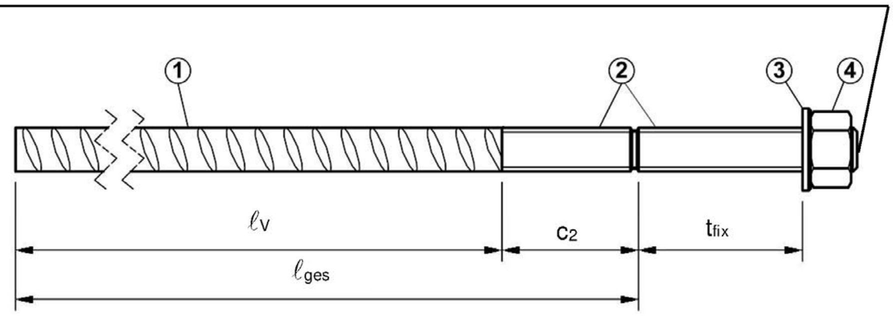


Table A2: Materials

Part	Designation	Material											
		ZA vz				ZA A4				ZA HCR			
		M12	M16	M20	M24	M12	M16	M20	M24	M12	M16	M20	M24
1	Reinforcement bar	Class B according to NDP or NCL of EN 1992-1-1/NA $f_{uk} = f_{tk} = k \cdot f_{yk}$											
2	Threaded rod	Steel, zinc plated according to EN 10087:1998 or EN 10263:2001				Stainless steel, 1.4362, 1.4401, 1.4404, 1.4571, EN 10088-1:2014				High corrosion resistant steel, 1.4529, 1.4565, EN 10088-1:2014			
	f_{yk} [N/mm²]	640				640			560	640			560
3	Washer	Steel, zinc plated according to EN 10087:1998 or EN 10263:2001				Stainless steel, 1.4362, 1.4401, 1.4404, 1.4571, EN 10088-1:2014				High corrosion resistant steel, 1.4529, 1.4565, EN 10088-1:2014			
4	Nut												

Table A3: Dimensions and installation parameter

Size				ZA-M12	ZA-M16	ZA-M20	ZA-M24
Diameter of threaded rod			[mm]	12	16	20	24
Diameter of reinforcement bar			[mm]	12	16	20	25
Drill hole diameter			[mm]	16	20	25	32
Diameter of clearance hole in fixture			[mm]	14	18	22	26
With across nut flats		SW	[mm]	19	24	30	36
Stress area		A_s	[mm²]	84	157	245	353
Effective embedment depth		ℓ_v	[mm]	according to static calculation			
Length of bonded thread	plated	c_2	[mm]	≥ 20	≥ 20	≥ 20	≥ 20
	A4/HCR			≥ 100	≥ 100	≥ 100	≥ 100
Minimum thickness of fixture		t_{fix}	[mm]	5	5	5	5
Maximum thickness of fixture		t_{fix}	[mm]	3000	3000	3000	3000
Maximum installation torque		T_{max}	[Nm]	50	100	150	150

RESINA VINILESTER + SIN ESTIRENO LUSAN for rebar connection

Product description
Specifications Tension Anchor ZA

Annex A 5

Specifications of intended use

Anchorages subject to:

- Static and quasi-static loads.
- Fire exposure

Base materials:

- Reinforced or unreinforced normal weight concrete according to EN 206:2013 + A1:2016.
- Strength classes C12/15 to C50/60 according to EN 206:2013 + A1:2016.
- Maximum chloride content of 0,40% (CL 0.40) related to the cement content according to EN 206:2013 + A1:2016.
- Non-carbonated concrete.

  Note: In case of a carbonated surface of the existing concrete structure the carbonated layer shall be removed in the area of the post-installed rebar connection with a diameter of ϕ + 60 mm prior to the installation of the new rebar.

  The depth of concrete to be removed shall correspond to at least the minimum concrete cover in accordance with EN 1992-1-1:2004+AC:2010.

  The foregoing may be neglected if building components are new and not carbonated and if building components are in dry conditions.

Temperature Range:

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

Use conditions (Environmental conditions) with tension anchor ZA:

- Structures subject to dry internal conditions or subject to external atmospheric exposure (including industrial and marine environment) and 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).

Design:

- Anchorages are designed under the responsibility of an engineer experienced in anchorages and concrete work.
- Verifiable calculation notes and drawings are prepared taking account of the forces to be transmitted.
- Design according to EN 1992-1-1:2004+AC:2010, EN 1992-1-2:2004+AC:2008 and Annex B 2 and B 3.
- The actual position of the reinforcement in the existing structure shall be determined on the basis of the construction documentation and taken into account when designing.

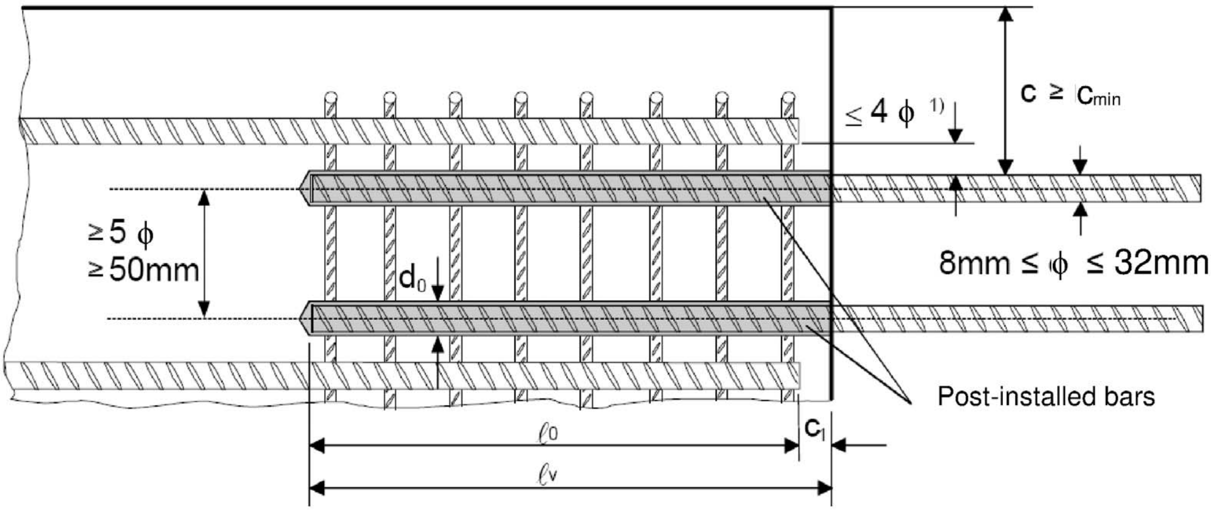
Installation:

- Dry or wet concrete.
- It must not be installed in flooded holes.
- Hole drilling by hammer drill (HD), hollow drill (HDB) or compressed air drill mode (CD).
- The installation of post-installed rebar resp. tension anchors shall be done only by suitable trained installer and under supervision on site; the conditions under which an installer may be considered as suitable trained and the conditions for supervision on site are up to the Member States in which the installation is done.
- Check the position of the existing rebars (if the position of existing rebars is not known, it shall be determined using a rebar detector suitable for this purpose as well as on the basis of the construction documentation and then marked on the building component for the overlap joint).

RESINA VINILESTER + SIN ESTIRENO LUSAN for rebar connection	**Annex B 1**
Intended use Specifications	

Figure B1: General construction rules for post-installed rebars

- Only tension forces in the axis of the rebar may be transmitted
- The transfer of shear forces between new concrete and existing structure shall be designed additionally according to EN 1992-1-1:2004+AC:2010.
- The joints for concreting must be roughened to at least such an extent that aggregate protrude.



1) If the clear distance between lapped bars exceeds 4ϕ, then the lap length shall be increased by the difference between the clear bar distance and 4ϕ.

The following applies to Figure B1:

c	concrete cover of post-installed rebar
c_1	concrete cover at end-face of existing rebar
c_{min}	minimum concrete cover according to Table B1 and to EN 1992-1-1:2004+AC:2010, Section 4.4.1.2
ϕ	diameter of post-installed rebar
ℓ_0	lap length, according to EN 1992-1-1:2004+AC:2010, Section 8.7.3
ℓ_v	effective embedment depth, $\geq \ell_0 + c_1$
d_0	nominal drill bit diameter, see Annex B 6

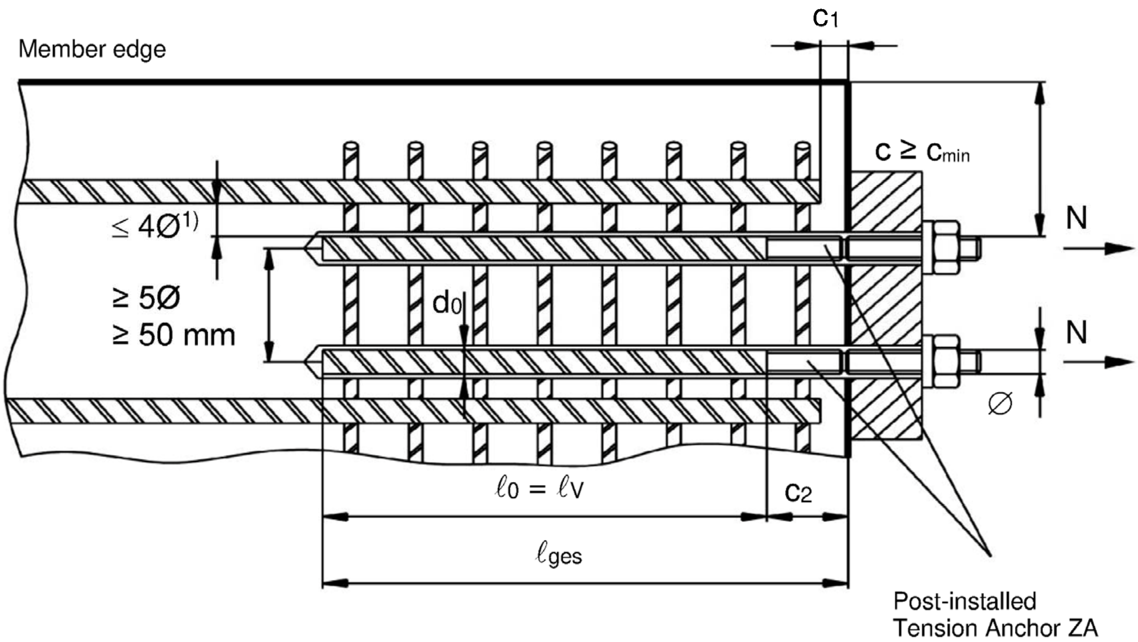
RESINA VINILESTER + SIN ESTIRENO LUSAN for rebar connection

Intended use
General construction rules for post-installed rebars

Annex B 2

Figure B2: General construction rules for tension anchors ZA

- The length of the bonded-in thread may be not be accounted as anchorage
- Only tension forces in the direction of the bar axis may be transmitted by the tension anchor ZA
- The tension force must be transferred via an overlap joint to the reinforcement in the building part.
- The transfer of shear forces shall be ensured by appropriate additional measures, e.g shear lugs or by anchors with an European technical assessment.
- In the anchor plate, the holes for the tension anchors shall be executed as elongated holes with axis in the direction of the shear force.



[1] If the clear distance between lapped bars exceeds 4ϕ, then the lap length shall be increased by the difference between the clear bar distance and 4ϕ.

The following applies to Figure B2:

c	concrete cover of tension anchor ZA
c_1	concrete cover at end-face of existing rebar
c_2	Length of bonded thread
c_{min}	minimum concrete cover according to Table B1 and to EN 1992-1-1:2004+AC:2010, Section 4.4.1.2
ϕ	diameter of tension anchor
ℓ_0	lap length, according to EN 1992-1-1:2004+AC:2010, Section 8.7.3
ℓ_v	effective embedment depth, $\geq \ell_0 + c_1$
ℓ_{ges}	overall embedment depth, $\geq \ell_0 + c_2$
d_0	nominal drill bit diameter, see Annex B 6

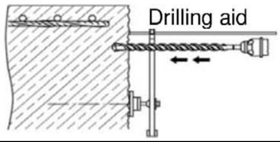
RESINA VINILESTER + SIN ESTIRENO LUSAN for rebar connection

Intended use
General construction rules for tension anchors

Annex B 3

Deutsches Institut für Bautechnik DIBt

Table B1: Minimum concrete cover min c[1)] of post-installed rebar depending of drilling method



Drilling method	Rebar diameter	Without drilling aid	With drilling aid
Hammer drilling (HD)	< 25 mm	30 mm + 0,06 · ℓ_v ≥ 2 ϕ	30 mm + 0,02 · ℓ_v ≥ 2 ϕ
	≥ 25 mm	40 mm + 0,06 · ℓ_v ≥ 2 ϕ	40 mm + 0,02 · ℓ_v ≥ 2 ϕ
Compressed air drilling (CD)	< 25 mm	50 mm + 0,08 · ℓ_v	50 mm + 0,02 · ℓ_v
	≥ 25 mm	60 mm + 0,08 · ℓ_v	60 mm + 0,02 · ℓ_v

1) see Annex B2, Figures B1 and Annex B3, Figure B2
Comments: The minimum concrete cover acc. EN 1992-1-1:2004+AC:2010 must be observed

Table B2: maximum embedment depth $\ell_{v,max}$

Rebar	Tension anchor	$\ell_{v,max}$ [mm]
ϕ	ϕ	
8 mm		1000
10 mm		1000
12 mm	ZA-M12	1200
14 mm		1400
16 mm	ZA-M16	1600
20 mm	ZA-M20	2000
22 mm		2000
24 mm		2000
25 mm	ZA-M24	2000
28 mm		1000
32 mm		1000

Table B3: Base material temperature, gelling time and curing time

Concrete temperature	Gelling working time[1)]	Minimum curing time in dry concrete	Minimum curing time in wet concrete
-10°C to -6°C	90 min[2)]	24 h	48 h
- 5 °C to - 1 °C	90 min[3)]	14 h	28 h
0 °C to + 4 °C	45 min[3)]	7 h	14 h
+ 5 °C to + 9 °C	25 min[3)]	2 h	4 h
+ 10 °C to + 19 °C	15 min[3)]	80 min	160 min
+ 20 °C to + 24 °C	6 min[3)]	45 min	90 min
+ 25 °C to + 29 °C	4 min[3)]	25 min	50 min
+ 30 °C to + 40 °C	2,5 min[4)]	15 min	30 min

1) t_{gel}: maximum time from starting of mortar injection to completing of rebar setting.
2) Cartridge temperature **must** be at minimum +15°C
3) Cartridge temperature **must** be between +5°C and +25°C
4) Cartridge temperature **must** be below +20°C

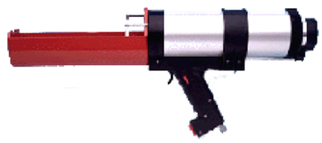
RESINA VINILESTER + SIN ESTIRENO LUSAN for rebar connection

Intended use
Minimum concrete cover
Maximum embedment depth / working time and curing times

Annex B 4

Deutsches Institut für Bautechnik DIBt

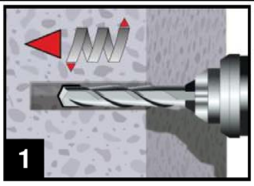
Table B4: Dispensing tools

Cartridge type/size	Hand tool		Pneumatic tool
Coaxial cartridges 150, 280, 300 up to 333 ml	 e.g. Type H 297 or H244C		 e.g. Type TS 492 X
Coaxial cartridges 380 up to 420 ml	 e.g. Type CCM 380/10	 e.g. Type H 285 or H244C	 e.g. Type TS 485 LX
Side-by-side cartridges 235, 345 ml	 e.g. Type CBM 330A	 e.g. Type H 260	 e.g. Type TS 477 LX
Side-by-side cartridge 825 ml	-	-	 e.g. Type TS 498X

All cartridges could also be extruded by a battery tool.

RESINA VINILESTER + SIN ESTIRENO LUSAN for rebar connection	**Annex B 5**
Intended Use Dispensing tools	

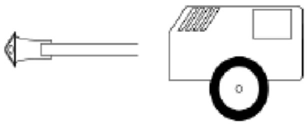
A) Bore hole drilling



1. Drill a hole into the base material to the size and embedment depth required by the selected reinforcing bar with carbide hammer drill (HD) or a compressed air drill (CD). In case of aborted drill hole: the drill hole shall be filled with mortar.

Rebar - ϕ	Tension anchor - ϕ	Drill - Ø [mm]
8 mm		12
10 mm		14
12 mm	ZA-M12	16
14 mm		18
16 mm	ZA-M16	20
20 mm	ZA-M20	25
22 mm		28
24 mm		32
25 mm	ZA-M24	32
28 mm		35
32 mm		40

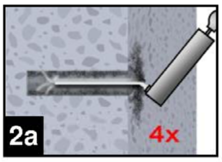
Hammer drill (HD)
Hollow drill (HDB)



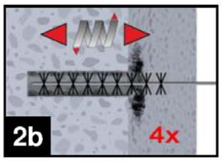
Compressed air drill (CD)

B) Bore hole cleaning (HD, HDB and CD)

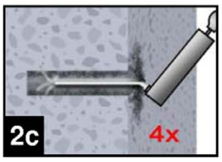
MAC: Cleaning for bore hole diameter $d_0 \leq 20mm$ and bore hole depth $h_0 \leq 10d_s$



2a. Starting from the bottom or back of the bore hole, blow the hole clean a hand pump (Annex B 7) a minimum of four times.

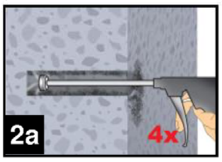


2b. Check brush diameter (Table B5). Brush the hole with an appropriate sized wire brush > $d_{b,min}$ (Table B5) a minimum of four times in a twisting motion.
If the bore hole ground is not reached with the brush, a brush extension shall be used.

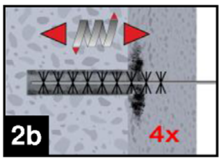


2c. Finally blow the hole clean again with a hand pump (Annex B 7) a minimum of four times.

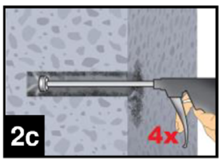
CAC: Cleaning for all bore hole diameter and bore hole depth



2a. Starting from the bottom or back of the bore hole, blow the hole clean with compressed air (min. 6 bar) (Annex B 7) a minimum of four times until return air stream is free of noticeable dust. If the bore hole ground is not reached an extension shall be used.



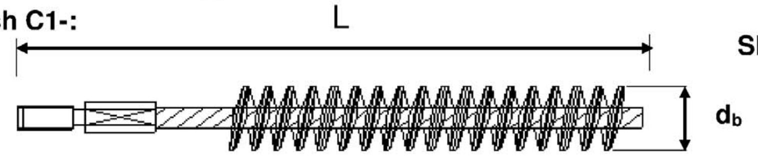
2b. Check brush diameter (Table B5). Brush the hole with an appropriate sized wire brush > $d_{b,min}$ (Table B5) a minimum of four times.
If the bore hole ground is not reached with the brush, a brush extension shall be used (Table B5).



2c. Finally blow the hole clean again with compressed air (min. 6 bar) (Annex B 7) a minimum of four times until return air stream is free of noticeable dust. If the bore hole ground is not reached an extension shall be used.

Table B5: Cleaning tools

Brush C1-:

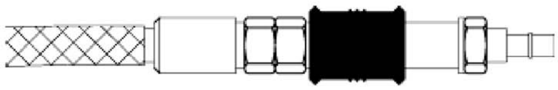


SDS Plus Adapter:

Brush extension:

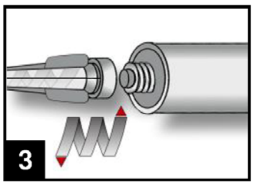
ϕ Rebar	ϕ Tension anchor	d_0 Drill bit - Ø	d_b Brush - Ø		$d_{b,min}$ min. Brush - Ø
(mm)	(mm)	(mm)		(mm)	
8		12	C1-12	14	12,5
10		14	C1-14	16	14,5
12	ZA-M12	16	C1-16	18	16,5
14		18	C1-18	20	18,5
16	ZA-M16	20	C1-20	22	20,5
20	ZA-M20	25	C1-25	27	25,5
22		28	C1-28	30	28,5
24		32	C1-32	34	32,5
25	ZA-M24	32	C1-32	34	32,5
28		35	C1-35	37	35,5
32		40	C1-40	41,5	40,5

Hand pump (volume 750 ml)

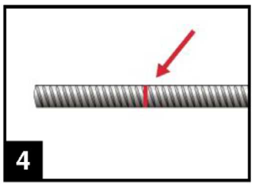


Rec. compressed air tool hand slide valve (min 6 bar)

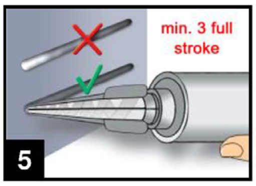
C) Preparation of bar and cartridge



3. Attach the supplied static-mixing nozzle to the cartridge and load the cartridge into the correct dispensing tool.
For every working interruption longer than the recommended working time (Table B3) as well as for every new cartridges, a new static-mixer shall be used.



4. Prior to inserting the reinforcing bar into the filled bore hole, the position of the embedment depth shall be marked (e.g. with tape) on the reinforcing bar and insert bar in empty hole to verify hole and depth ℓ_v.
The reinforcing bar should be free of dirt, grease, oil or other foreign material.



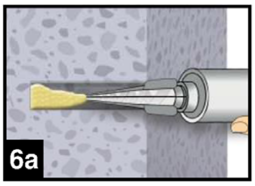
5. Prior to dispensing into the anchor hole, squeeze out separately the mortar until it shows a consistent grey colour, but a minimum of three full strokes, and discard non-uniformly mixed adhesive components.

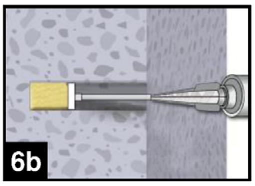
RESINA VINILESTER + SIN ESTIRENO LUSAN for rebar connection

Intended Use
Installation instruction: Cleaning tools and Preparation of bar and cartridge

Annex B 7

D) Filling the bore hole





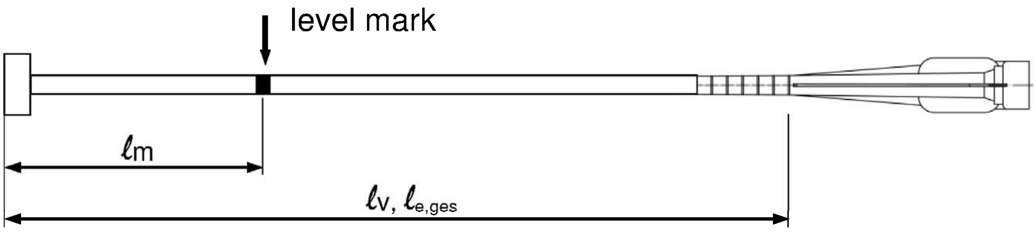
6. Starting from the bottom or back of the cleaned bore hole fill the hole with adhesive, until the level mark at the mixer extension (see below) is visible at the top of the hole. For embedment larger than 190 mm an extension nozzle shall be used.
Slowly withdraw the static mixing nozzle and using a piston plugs during injection of the mortar, helps to avoid creating air pockets.

For overhead and horizontal installation and bore holes deeper than 240 mm a piston plug and the appropriate mixer extension must be used.

Observe the gel-/ working times given in Table B3.

Table B6: Piston plugs, max anchorage depth and mixer extension

Bar size	Tension anchor	Drill bit - Ø		Piston plug	Cartridge: All sizes				Cartridge: side-by-side (825 ml)	
					Hand or battery tool		Pneumatic tool		Pneumatic tool	
ϕ	ϕ	HD, HDB	CD		$l_{v,max}$	Mixer extension	$l_{v,max}$	Mixer extension	$l_{v,max}$	Mixer extension
[mm]	[mm]	[mm]			[cm]		[cm]		[cm]	
8		12	-	-	70	VL 10/0,75	80	VL 10/0,75	80	VL 10/0,75
10		14	-	VS14			100		100	
12	ZA-M12	16		VS16					120	VL 16/1,8
14		18		VS18					140	
16	ZA-M16	20		VS20					160	
20	ZA-M20	25	26	VS25	50		70		200	
22		28		VS28						
24		32		VS32			50			
25	ZA-M24	32		VS32						
28		35		VS35					200	
32		40		VS40						



Injection tool must be marked by mortar level mark ℓ_m and anchorage depth ℓ_v resp. $\ell_{e,ges}$ with tape or marker.

Quick estimation: $\ell_m = 1/3 \cdot \ell_v$

Continue injection until the mortar level mark ℓ_m becomes visible.

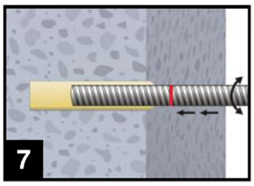
Optimum mortar volume: $\ell_m = \ell_v \text{ resp. } \ell_{e,ges} \cdot \left(1{,}2 \cdot \frac{\phi^2}{d_0^2} - 0{,}2\right)$ [mm]

RESINA VINILESTER + SIN ESTIRENO LUSAN for rebar connection

Intended Use
Installation instruction: Filling the bore hole

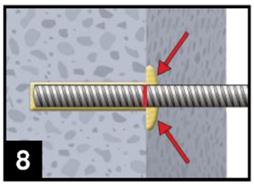
Annex B 8

E) Inserting the rebar

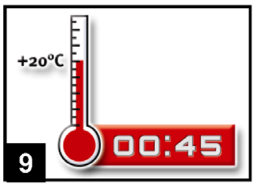


7. Push the reinforcing bar into the anchor hole while turning slightly to ensure positive distribution of the adhesive until the embedment depth is reached.

   The bar should be free of dirt, grease, oil or other foreign material.



8. Be sure that the bar is inserted in the bore hole until the embedment mark is at the concrete surface and that excess mortar is visible at the top of the hole. If these requirements are not maintained, the application has to be renewed. For overhead installation fix embedded part (e.g. wedges).



9. Observe gelling time t_{gel}. Attend that the gelling time can vary according to the base material temperature (see Table B3).
   Do not move or load the bar until full curing time t_{cure} has elapsed (attend Table B3).

RESINA VINILESTER + SIN ESTIRENO LUSAN for rebar connection	**Annex B 9**
Intended Use Installation instruction: Inserting rebar	

Minimum anchorage length and minimum lap length

The minimum anchorage length $\ell_{b,min}$ and the minimum lap length $\ell_{0,min}$ according to EN 1992-1-1:2004+AC:2010 ($\ell_{b,min}$ acc. to Eq. 8.6 and Eq. 8.7 and $\ell_{0,min}$ acc. to Eq. 8.11) shall be multiply by the amplification factor α_{lb} according to Table C1.

Table C1: Amplification factor α_{lb} related to concrete class and drilling method

Concrete class	Drilling method	Bar size	Amplification factor α_{lb}
C12/15 to C50/60	Hammer drilling (HD), hollow drilling (HDB) and compressed air drilling (CD)	8 mm to 32 mm ZA-M12 to ZA-M24	1,0

Table C2: Reduction factor k_b for all drilling methods

Rebar - Ø	Concrete class								
ϕ	C12/15	C16/20	C20/25	C25/30	C30/37	C35/45	C40/50	C45/55	C50/60
8 to 25 mm ZA-M12 to ZA-M24	1,0								
28 to 32 mm	1,0							0,92	0,86

Table C3: Design values of the ultimate bond stress $f_{bd,PIR}$ in N/mm² for all drilling methods and for good conditions

$$f_{bd,PIR} = k_b \cdot f_{bd}$$

with

f_{bd}: Design value of the ultimate bond stress in N/mm² considering the concrete classes and the rebar diameter according to EN 1992-1-1:2004+AC:2010.
(for all other bond conditions multiply the values by 0.7)

k_b: Reduction factor according to Table C2

Rebar - Ø	Concrete class								
ϕ	C12/15	C16/20	C20/25	C25/30	C30/37	C35/45	C40/50	C45/55	C50/60
8 to 25 mm ZA-M12 to ZA-M24	1,6	2,0	2,3	2,7	3,0	3,4	3,7	4,0	4,3
28 to 32 mm	1,6	2,0	2,3	2,7	3,0	3,4	3,7	3,7	3,7

Design value of the ultimate bond stress $f_{bd,fi}$ at increased temperature for concrete classes C12/15 to C50/60, (all drilling methods):

The design value of the bond stress $f_{bd,fi}$ at increased temperature has to be calculated by the following equation:

$$f_{bd,fi} = k_{fi}(\theta) \cdot f_{bd,PIR} \cdot \gamma_c / \gamma_{M,fi}$$

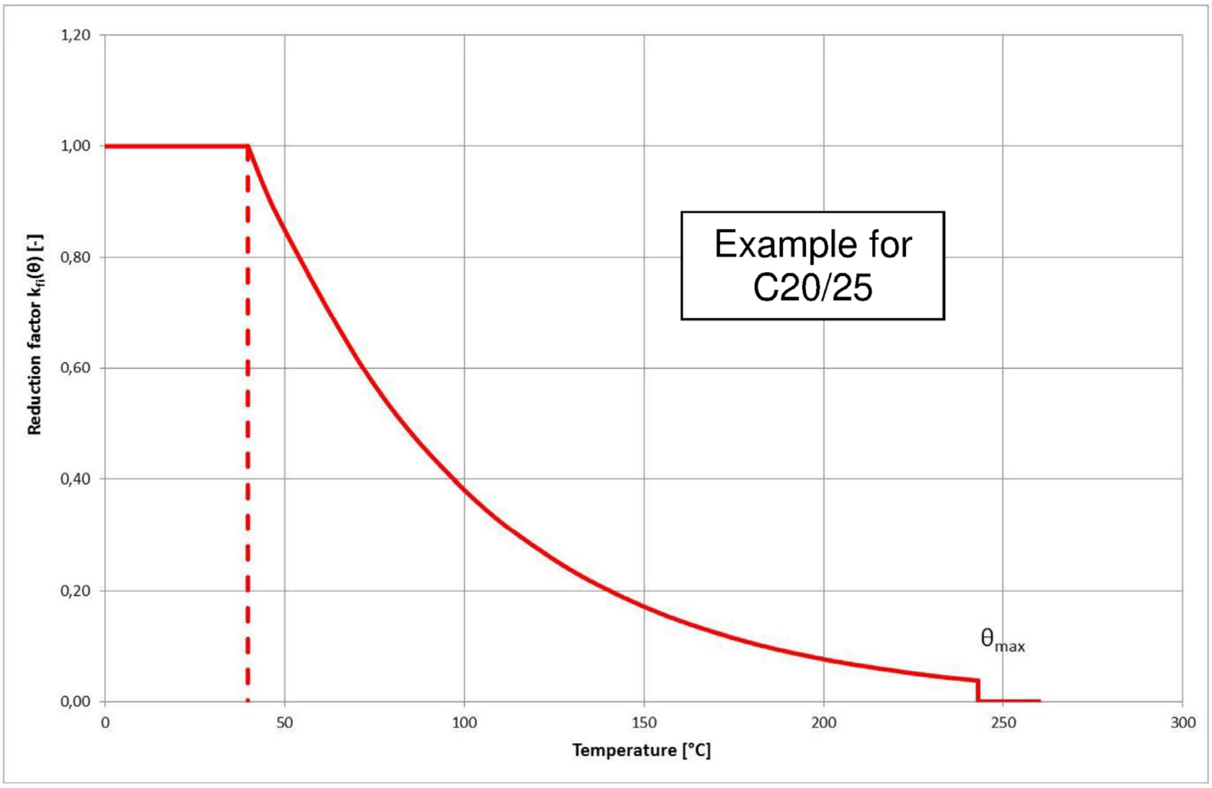
with: $\theta \leq 243°C$: $k_{fi}(\theta) = 18{,}88 \cdot e^{(\theta \cdot -0{,}016)} / (f_{bd,PIR} \cdot 4{,}3) \leq 1{,}0$
$\theta > 243°C$: $k_{fi}(\theta) = 0$

$f_{bd,fi}$ Design value of the ultimate bond stress at increased temperature in N/mm²

θ Temperature in °C in the mortar layer.
$k_{fi}(\theta)$ Reduction factor at increased temperature.
$f_{bd,PIR}$ Design value of the bond stress in N/mm² in cold condition according to Table C3 considering the concrete classes, the rebar diameter, the drilling method and the bond conditions according to EN 1992-1-1:2004+AC:2010.
γ_c = 1,5, recommended partially safety factor according to EN 1992-1-1:2004+AC:2010
$\gamma_{M,fi}$ = 1,0, recommended partially safety factor according to EN 1992-1-2:2004+AC:2008

For evidence at increased temperature the anchorage length shall be calculated according to EN 1992-1-1:2004+AC:2010 Equation 8.3 using the temperature-dependent design value of ultimate bond stress $f_{bd,fi}$.

Example graph of Reduction factor $k_{fi}(\theta)$ for concrete classes C20/25 for good bond conditions:



RESINA VINILESTER + SIN ESTIRENO LUSAN for rebar connection	**Annex C 2**
Performances Design value of ultimate bond stress $f_{bd,fi}$ at increased temperature	

Table C4: Characteristic tension strength for tension anchor ZA under fire exposure,
concrete classes C12/15 to C50/60, according to Technical Report TR 020

Tension Anchor				**ZA-M12**	**ZA-M16**	**ZA-M20**	**ZA-M24**
Steel, zinc plated (ZA vz)							
Characteristic steel strength	R30	$\sigma_{Rk,s,fi}$	[N/mm²]	20			
	R60			15			
	R90			13			
	R120			10			
Stainless Steel (ZA A4 or ZA HCR)							
Characteristic steel strength	R30	$\sigma_{Rk,s,fi}$	[N/mm²]	30			
	R60			25			
	R90			20			
	R120			16			

Design value of the steel strength $\sigma_{Rd,s,fi}$ under fire exposure

The design value of the steel strength $\sigma_{Rd,s,fi}$ under fire exposure has to be calculated by the following equation:

$$\sigma_{Rd,s,fi} = \sigma_{Rk,s,fi} / \gamma_{M,fi}$$

with:

$\sigma_{Rk,s,fi}$ characteristic steel strength according to Table C4
$\gamma_{M,fi}$ partially safety factor according to EN 1992-1-2:2004+AC:2008

RESINA VINILESTER + SIN ESTIRENO LUSAN for rebar connection

Performances
Design value of the steel strength $\sigma_{Rd,s,fi}$ for tension anchor ZA under fire exposure

Annex C 3