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European Technical Assessment

ETA 20/0618 of 01/12/2023

Technical Assessment Body issuing the ETA: Technical and Test Institute for Construction Prague	
Trade name of the construction product	WCF-EASF WCF-EASF-C WCF-EASF-E
Product family to which the construction product belongs	Product area code: 33 Injection anchors for use in masonry
Manufacturer	KLIMAS sp. z o.o. Ul.Wincentego Witosa 135/137 Kuźnica Kiedrzyńska 42-233 Mykanów, POLSKA
Manufacturing plant(s)	Plant no. 3
This European Technical Assessment contains	19 pages including 16 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 330076-01-0604 Metal injection anchors for use in masonry
This version replaces	ETA 20/0618 issued on 07/04/2022

1. Technical description of the product

The WCF-EASF, WCF-EASF-C (faster curing time) and WCF-EASF-E (extended curing time) for masonry is a bonded anchor consisting of a cartridge with injection mortar, a plastic sieve sleeve and an anchor rod with a hexagon nut and a washer. The steel elements are made of galvanized steel or stainless steel.

The sieve sleeve is pushed into a drilled hole and filled with injection mortar before the anchor rod is placed in the sieve sleeve. The steel element is anchored via the bond between metal part, injection mortar and masonry.

The illustration and the description of the product are given in Annex A.

2. Specification of the intended use in accordance with the applicable EAD

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 provisions made in this European Technical Assessment are based on an assumed working life of the anchor of 50 years. The indications given on the working life cannot be interpreted as a guarantee given by the producer, but are to be regarded only as a means for choosing the 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
Reduction factor for job site tests (β – factor)	See Annex C 1 to C 4
Characteristic resistance	See Annex C 1 to C 4
Edge distances and spacing	See Annex B 6, B 7
Displacements	See Annex C 1 to C 4
Durability	See Annex A 3

3.2 Safety in case of fire (BWR 2)

Essential characteristic	Performance
Reaction to fire	Anchorages satisfy requirements for Class A1

3.3 Hygiene, health and environment (BWR 3)

No performance determined.

3.4 General aspects relating to fitness for use

Durability and serviceability are only ensured if the specifications of intended use according to Annex B 1 are kept.

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

According to the Decision 97/177/EC of the European Commission[1], the system of assessment and verification of constancy of performance (see Annex V to Regulation (EU) No 305/2011) given in the following table applies.

Product	Intended use	Level or class	System
Injection anchors for use in masonry	For fixing and/or supporting to masonry, structural elements (which contributes to the stability of the works) or heavy units	-	1

[1] Official Journal of the European Communities L 073 of 14.03.1997

5. Technical details necessary for the implementation of the AVCP system, as provided in the applicable EAD

The factory production control shall be in accordance with the control plan which is a part of the technical documentation of this European Technical Assessment. The control plan is laid down in the context of the factory production control system operated by the manufacturer and deposited at Technický a zkušební ústav stavební Praha, s.p.[2] The results of factory production control shall be recorded and evaluated in accordance with the provisions of the control plan.

Issued in Prague on 01.12.2023

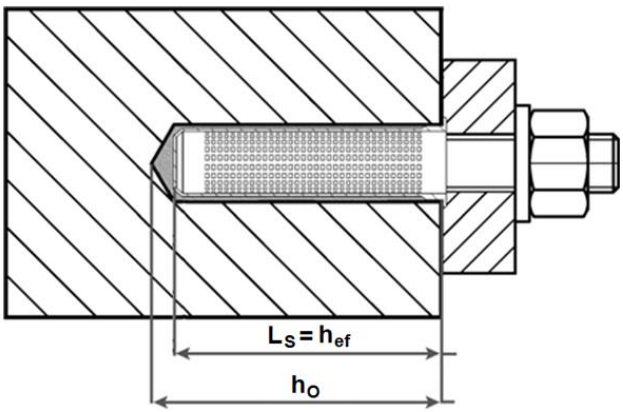
By

Ing. Jiří Studnička, Ph.D.
Head of the Technical Assessment Body

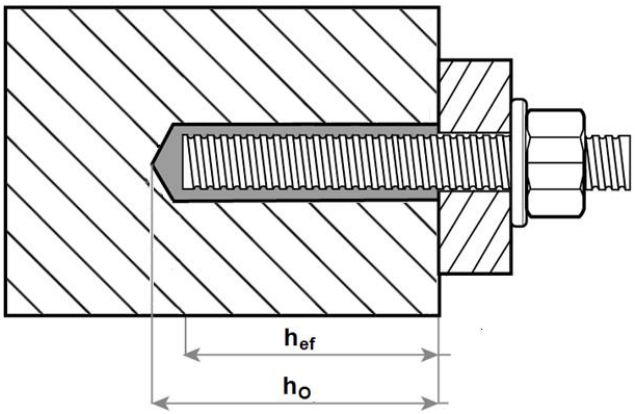
[2] The control plan is a confidential part of the documentation of the European Technical Assessment, but not published together with the ETA and only handed over to the approved body involved in the procedure of AVCP.

Installation in solid brick masonry

Installation of anchor rod with sieve sleeve

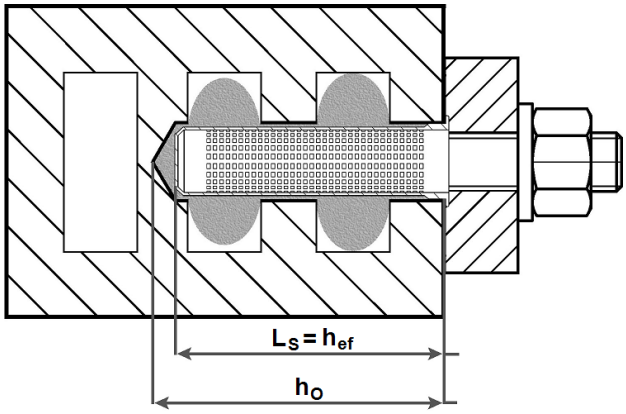


Installation of anchor rod without sieve sleeve



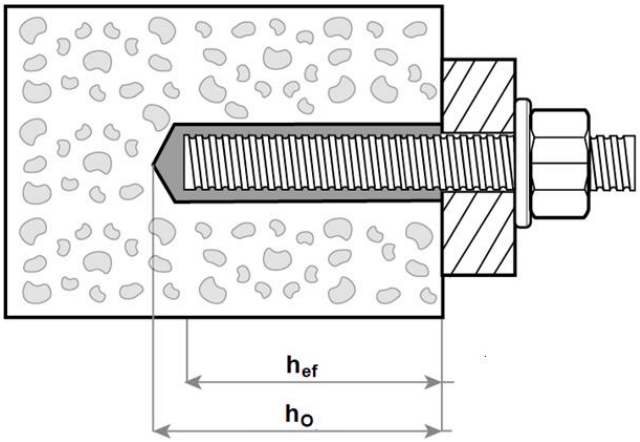
Installation in hollow or perforated brick masonry

Installation of anchor rod with sieve sleeve



Installation in autoclaved aerated concrete

Installation of anchor rod without sieve sleeve



L_s = length of the sieve sleeve
h_{ef} = effective setting depth
h_0 = bore hole depth

WCF-EASF, WCF-EASF-C, WCF-EASF-E for masonry	**Annex A 1**
Product description Installed condition	

Coaxial cartridge

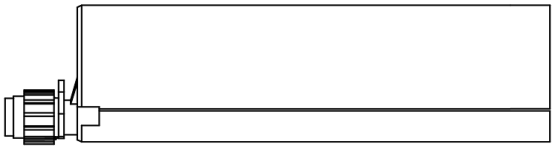
WCF-EASF, WCF-EASF-C, WCF-EASF-E

150 ml
380 ml
400 ml
410 ml

Side by side cartridge

WCF-EASF, WCF-EASF-C, WCF-EASF-E

350 ml
825 ml



Two part foil in a single piston component cartridge

WCF-EASF, WCF-EASF-C, WCF-EASF-E

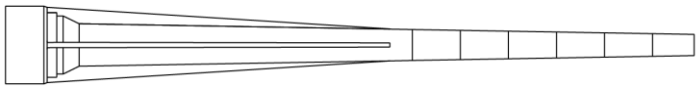
150 ml
170 ml
300 ml
550 ml
850 ml

Marking of the mortar cartridges

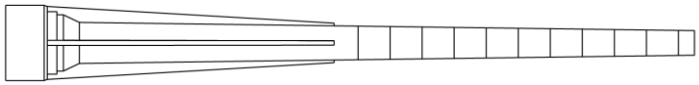
Identifying mark of the producer, Trade name, Charge code number, Storage life, Curing and processing time

Mixing nozzle

NN



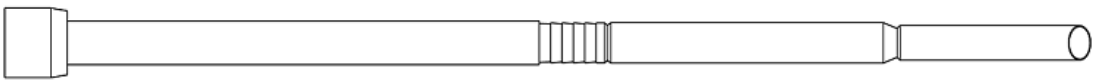
WN



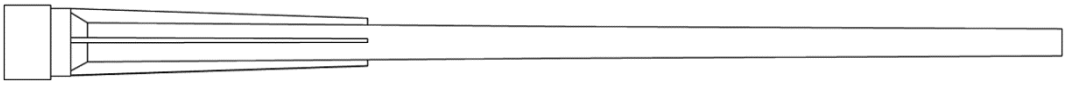
EN

SN

LN

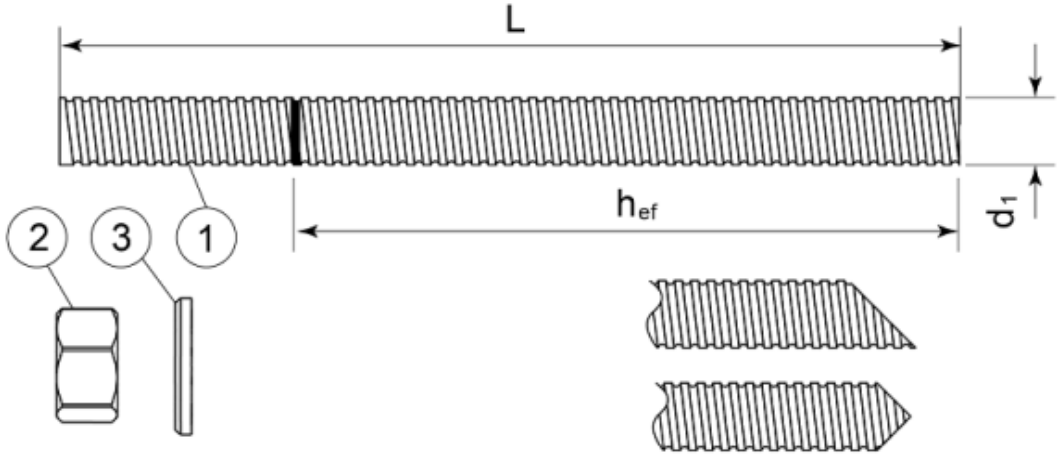


KN for 850



WCF-EASF, WCF-EASF-C, WCF-EASF-E for masonry	**Annex A 2**
Product description Injection system	

Threaded rod M6, M8, M10, M12, M16



Standard commercial threaded rod with marked embedment depth

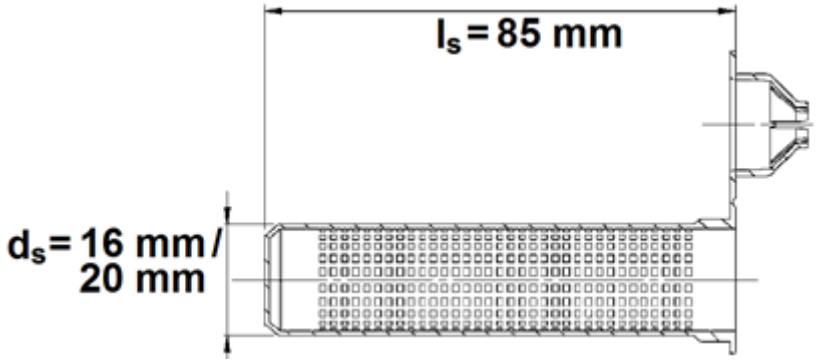
Part	Designation	Material
Steel, zinc plated ≥ 5 µm acc. to EN ISO 4042 or Steel, Hot-dip galvanized ≥ 40 µm acc. to EN ISO 1461 and EN ISO 10684 or Steel, zinc diffusion coating ≥ 15 µm acc. to EN 13811 or Steel, zinc flake ≥ 8 µm acc. to EN ISO 2178:2016		
1	Anchor rod	Steel, EN 10087 or EN 10263 KPG 4.6[1)], KPG 5.8, KPG 8.8, KPG 10.9[2)] EN ISO 898-1
2	Hexagon nut EN ISO 4032	According to threaded rod, EN 20898-2
3	Washer EN ISO 887, EN ISO 7089, EN ISO 7093 or EN ISO 7094	According to threaded rod
Stainless steel		
1	Anchor rod	KPG A2-70, KPG A4-70, KPG A4-80 EN ISO 3506
2	Hexagon nut EN ISO 4032	According to threaded rod
3	Washer EN ISO 887, EN ISO 7089, EN ISO 7093 or EN ISO 7094	According to threaded rod
High corrosion resistant steel		
1	Anchor rod	KPG HCR, KPG UHCR EN 10088-1
2	Hexagon nut EN ISO 4032	According to threaded rod
3	Washer EN ISO 887, EN ISO 7089, EN ISO 7093 or EN ISO 7094	According to threaded rod

[1)] Only for use in Autoclaved aerated concrete

[2)] Galvanized rod of high strength are sensitive to hydrogen induced brittle failure

WCF-EASF, WCF-EASF-C, WCF-EASF-E for masonry	**Annex A 3**
Product description Threaded rod and materials	

Sieve sleeve



Types:
TSN16/85
TSN20/85

Designation	Material
Sieve sleeve	Polypropylene

WCF-EASF, WCF-EASF-C, WCF-EASF-E for masonry	**Annex A 4**
Product description Sleeve	

Specifications of intended use

Anchorages subject to:
- Static and quasi-static loads

Base materials
- Solid brick masonry (Use category b), according to Annex B2.
- Hollow brick masonry (Use category c), according to Annex B2.
- Autoclaved aerated concrete (Masonry group d), according to Annex B3.
- Mortar strength class of the masonry M2,5 at minimum according to EN 998-2:2010.
- For other bricks in solid masonry, hollow or perforated masonry or autoclaved aerated concrete the characteristic resistance of the anchorages may be determined by job site tests according to EOTA Technical Report TR 053 and under consideration of the β-factor to Annex C1, Table C4 or Annex C 2, Table C8.

Note: The characteristic resistance for solid bricks are also valid for larger brick sizes and larger compressive strength of the masonry unit.

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)

Use conditions (Environmental conditions)
- (X1) Structures subject to dry, internal conditions (zinc coated steel, stainless steel, high corrosion resistance steel)
- (X2) Structures subject to external atmospheric exposure (including industrial and marine environment) or exposure in permanently damp internal condition, if no particular aggressive conditions exist (stainless steel A4, high corrosion resistant steel)
- (X3) Structures subject to external atmospheric exposure or exposure in permanently damp internal conditions or particularly aggressive conditions such as permanent or alternate immersion in seawater or the splash zone of seawater, chloride atmosphere of indoor swimming pools or atmosphere with extreme chemical pollution (e.g. in desulfurization plants or road tunnels, where de-icing materials are used) (high corrosion resistant steel)

Use categories in respect of installation and use:
- Category d/d - Installation and use in structures subject to dry, internal conditions
- Category w/d - Installation in dry or wet substrate and use in structures subject to dry, internal conditions
- Category w/w - Installation and use in structures subject to dry or wet environmental conditions

Design:
- Verifiable calculation notes and drawings are prepared taking account the relevant masonry in the region of the anchorage, the loads to be transmitted and their transmission to the supports of the structure. The position of the anchor is indicated on the design drawings.
- The anchorage are designed in accordance with the EOTA Technical Report TR 054, Design method A,, under the responsibility of an engineer experienced in anchorages and masonry work.

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.

WCF-EASF, WCF-EASF-C, WCF-EASF-E for masonry	**Annex B 1**
Intended use Specifications	

Table B1: Types and dimensions of block and bricks

Brick N° 1  Hollow clay brick Hueco Doble according to EN 771-1 length/width/height = 245 mm / 110 mm / 88 mm $f_b \geq 2{,}5$ N/mm^2 / $\rho \geq 0{,}74$ kg/dm^3	**Brick N° 2**  Hollow clay brick Porotherm P+W according to EN 771-1 length/width/height = 373 mm/250 mm/238 mm $f_b \geq 12$ N/mm^2 / $\rho \geq 0{,}9$ kg/dm^3
Brick N° 3  Solid clay brick Mz-NF according to EN 771-1 length/width/height = 240 mm / 115 mm / 71 mm $f_b \geq 20$ N/mm^2 / $\rho \geq 1{,}9$ kg/dm^3	**Brick N° 4**  Solid calcium silicate brick KSV-NF according to EN 771-2 length/width/height = 240 mm / 115 mm / 71 mm $f_b \geq 25$ N/mm^2 / $\rho \geq 1{,}8$ kg/dm^3
Brick N° 5  Perforated calcium silicate brick KSL-R-12-1,2-16DF according to EN 771-2 length/width/height = 239 mm / 248 mm / 239 mm $f_b \geq 15$ N/mm^2 / $\rho \geq 1{,}3$ kg/dm^3	

WCF-EASF, WCF-EASF-C, WCF-EASF-E **for masonry**	**Annex B 2**
Intended use Brick types and properties	

Table B2: Types and dimensions of block and bricks

Brick No.	Strength class acc. to EN 771-4	L/W/H (mm)	f_b (N/mm^2)	ρ (kg/dm^3)
N° 6	Autoclaved aerated concrete AAC2	599/375/249	≥ 2,0	≥ 0,35
N° 7	Autoclaved aerated concrete AAC3	599/375/249	≥ 3,0	≥ 0,40
N° 8	Autoclaved aerated concrete AAC4	599/375/249	≥ 4,0	≥ 0,50
N° 9	Autoclaved aerated concrete AAC5	599/375/249	≥ 5,0	≥ 0,60
N° 10	Autoclaved aerated concrete AAC6	499/240/250	≥ 6,0	≥ 0,65

Applicator gun

A

B

C

D

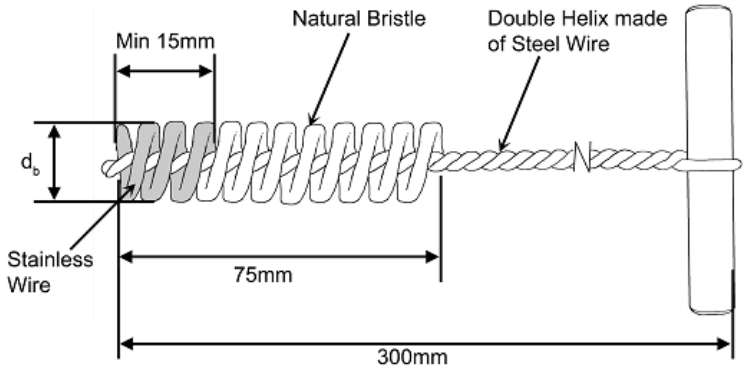
E

F

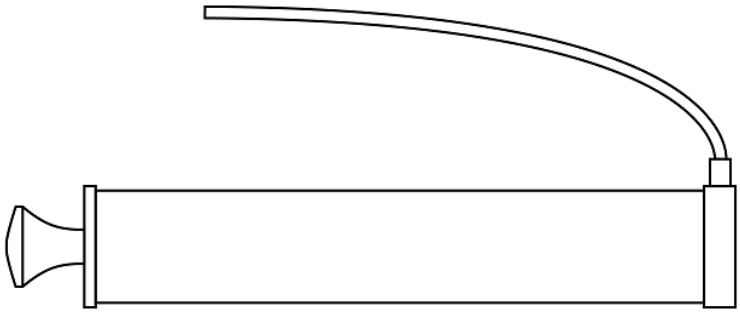
G

Applicator gun	A	B	C	D	E	F	G
Cartridge	Coaxial 380ml 400ml 410ml	Side by side 350ml	Foil capsule 150ml 300ml 550ml	Foil capsule 150ml 300ml	Coaxial 150ml	Side by side 825ml	Foil capsule 850ml

Cleaning brush

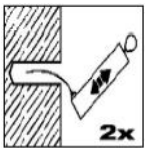
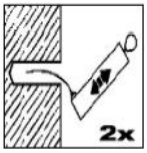
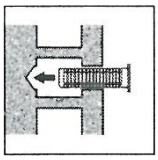
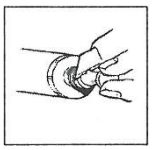
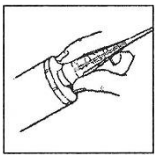
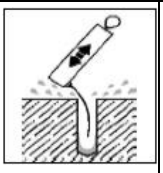
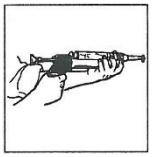
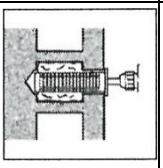
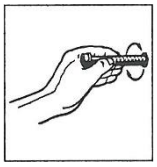
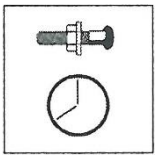
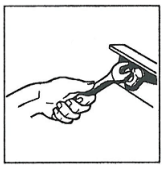


Cleaning pump



WCF-EASF, WCF-EASF-C, WCF-EASF-E for masonry	
Intended use Applicator guns Cleaning brush, Cleaning pump	**Annex B 4**

Installation instructions

	**1.** Drill the hole to the correct diameter and depth using a rotary percussive machine.		**2.** Use the cleaning pump to clean the hole.
	**3.** Use the cleaning brush to clean the hole. Diameter of cleaning brush according to Table B3, B5 or B7.		**4.** Use the cleaning pump to clean the hole.
	**5.** Use the cleaning brush to clean the hole. Diameter of cleaning brush according to Table B3, B5 or B7.		**6.** Use the cleaning pump to clean the hole.
	**7.** If use in hollow or perforated brick masonry: Plug the centering cap and insert the correct perforated sleeve flush with the surface of the base material.		**8.** Once the hole is prepared remove the screw cap from the cartridge.
	**9**. Attach the mixer nozzle and place the cartridge in the applicator gun.		**10.** Dispense the first part to waste, until an even colour is achieved.
	**11.** Remove any free water from the hole.		**12.** Insert the nozzle to the far end of the hole (using extension tubing if necessary) and inject the resin, withdrawing the nozzle/tube as the hole fills.
	**13.** If use in hollow or perforated brick masonry: Insert mixer nozzle to the end of the perforated sleeve and completely fill the sleeve with resin. Withdraw the mixer nozzle as the sleeve fills.		**14.** Immediately insert the fixing (steel element) slowly and with a slight twisting motion. Remove excess resin from around the mouth of the hole.
	**15.** Leave the fixing undisturbed until the cure time (see Table B9) has elapsed.		**16.** Attach the fixture and tighten the nut. Maximum installation torque moment according to Table B3, B5 or B7.

WCF-EASF, WCF-EASF-C, WCF-EASF-E for masonry	**Annex B 5**
Intended use Installation instructions	

Table B3: Installation parameters in solid or hollow masonry with sleeve

Anchor type			Anchor rod with sleeve				
Size			M8	M10	M12		M16
Sieve sleeve	l_s	[mm]	85	85	85		85
	d_s	[mm]	16	16	16	20	20
Nominal drill hole diameter	d_0	[mm]	16	16	16	20	20
Diameter of cleaning brush	d_b	[mm]	$20^{\pm1}$	$20^{\pm1}$	$20^{\pm1}$	$22^{\pm1}$	$22^{\pm1}$
Depth of the drill hole	h_0	[mm]	90				
Effective anchorage depth	h_{ef}	[mm]	85				
Diameter of clearance hole in the fixture	$d_f \leq$	[mm]	9	12	14		18
Torque moment	$T_{inst} \leq$	[Nm]	2				

Table B4: Edge distances and spacing in solid or hollow masonry with sleeve

Anchor rod						
Base material [1]	M8, M10, M12[2]			M12[3], M16		
	$c_{cr} = c_{min}$	$s_{cr\,\parallel} = s_{min\,\parallel}$	$s_{cr\perp} = s_{min\perp}$	$c_{cr} = c_{min}$	$s_{cr\,\parallel} = s_{min\,\parallel}$	$s_{cr\perp} = s_{min\perp}$
	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
Brick N° 1	100	245	110	120	245	110
Brick N° 2	100	373	238	120	373	238
Brick N° 3	128	255	255	128	255	255
Brick N° 4	128	255	255	125	255	255
Brick N° 5	100	239	248	120	239	248

[1] Brick N° according to Annex B 2
[2] M12 with sleeve TSN16/85
[3] M12 with sleeve TSN20/85

Table B5: Installation parameters in solid masonry without sleeve

Anchor type			Anchor rod without sleeve				
Size			M6	M8	M10	M12	M16
Nominal drill hole diameter	d_0	[mm]	8	10	12	14	18
Diameter of cleaning brush	d_b	[mm]	$9^{\pm1}$	$14^{\pm1}$	$14^{\pm1}$	$14^{\pm1}$	$20^{\pm1}$
Depth of the drill hole	h_0	[mm]	80	90			
Effective anchorage depth	h_{ef}	[mm]	80	90			
Diameter of clearance hole in the fixture	$d_f \leq$	[mm]	7	9	12	14	18
Torque moment	$T_{inst} \leq$	[Nm]	2				

Table B6: Edge distances and spacing in solid masonry without sleeve

Anchor rod						
Base material [1]	M6			M8, M10, M12, M16		
	$c_{cr} = c_{min}$	$s_{cr\,\parallel} = s_{min\,\parallel}$	$s_{cr\perp} = s_{min\perp}$	$c_{cr} = c_{min}$	$s_{cr\,\parallel} = s_{min\,\parallel}$	$s_{cr\perp} = s_{min\perp}$
	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
Brick N° 3	120	240	240	135	270	270
Brick N° 4	120	240	240	135	270	270

[1] Brick N° according to Annex B 2

WCF-EASF, WCF-EASF-C, WCF-EASF-E for masonry

Intended use
Installation parameters

Annex B 6

Table B7: Installation parameters in autoclaved aerated concrete

Base material			Brick No. 6 - 10				
Anchor type			Anchor rod without sleeve				
Size			M6	M8	M10	M12	M16
Nominal drill hole diameter	d_0	[mm]	8	10	12	14	18
Diameter of cleaning brush	d_b	[mm]	$9^{\pm1}$	$14^{\pm1}$	$14^{\pm1}$	$20^{\pm1}$	$20^{\pm1}$
Depth of the drill hole	h_0	[mm]	80			95	105
Effective anchorage depth	h_{ef}	[mm]	75			90	100
Diameter of clearance hole in the fixture	$d_f \leq$	[mm]	7	9	12	14	18
Torque moment	$T_{inst} \leq$	[Nm]	2				

Table B8: Edge distances and spacing autoclaved aerated concrete

Anchor rod									
Base material [1)]	M6, M8, M10			M12			M16		
	$c_{cr} = c_{min}$	$s_{cr,\parallel} = s_{min,\parallel}$	$s_{cr,\perp} = s_{min,\perp}$	$c_{cr} = c_{min}$	$s_{cr,\parallel} = s_{min,\parallel}$	$s_{cr,\perp} = s_{min,\perp}$	$c_{cr} = c_{min}$	$s_{cr,\parallel} = s_{min,\parallel}$	$s_{cr,\perp} = s_{min,\perp}$
	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
Brick N°6	113	225	225	135	270	270	150	300	300
Brick N°7	113	225	225	135	270	270	150	300	300
Brick N°8	113	225	225	135	270	270	150	300	300
Brick N°9	113	225	225	135	270	270	150	300	300
Brick N°10	113	225	225	135	270	270	150	300	300

[1)] Brick N° according to Annex B 3

WCF-EASF, WCF-EASF-C, WCF-EASF-E for masonry

Intended use
Installation parameters

Annex B 7

Table B9: Minimum curing time

WCF-EASF			
Resin cartridge temperature [°C]	**T Work [mins]**	**Base material Temperature [°C]**	**T Load [mins]**
+10	30 mins	-10 to -5	24 hours
+5	20 mins	-5 to 0	300 mins
0 to +5	15 mins	0 to +5	210 mins
+5 to +10	10 mins	+5 to +10	145 mins
+10 to +15	8 mins	+10 to +15	85 mins
+15 to +20	6 mins	+15 to +20	75 mins
+20 to +25	5 mins	+20 to +25	50 mins
+25 to +30	4 mins	+25 to +30	40 mins

WCF-EASF-C			
Resin cartridge temperature [°C]	**T Work [mins]**	**Base material Temperature [°C]**	**T Load [mins]**
+20	40 mins	-20 to -15[1)]	24 hours
+20	30 mins	-15 to -10[1)]	18 hours
+5	20 mins	-10 to -5	12 hours
+5	15 mins	-5 to 0	100 mins
0 to +5	10 mins	0 to +5	75 mins
+5 to +20	5 mins	+5 to +20	50 mins
+20	100 second	+20	20 mins

[1)] characteristic values of resistance see Annex C 2 and C 4

WCF-EASF-E			
Resin cartridge temperature [°C]	**T Work [mins]**	**Base material Temperature [°C]**	**T Load [mins]**
+15 to +20	15 mins	+15 to +20	5 hours
+20 to +25	10 mins	+20 to +25	145 mins
+25 to +30	7.5 mins	+25 to +30	85 mins
+30 to +35	5 mins	+30 to +35	50 mins
+35 to +40	3.5 mins	+35 to +40	40 mins

T work is typical gel time at highest temperature T load is set at the lowest temperature

Table C1: Characteristic resistance under tension and shear loading

Base material	Anchor rods with sleeve $N_{Rk} = V_{Rk}$ [kN] 1)					Anchor rods without sleeve $N_{Rk} = V_{Rk}$ [kN] 1)				
	M8	M10	M12	M12	M16	M6	M8	M10	M12	M16
Sleeve	16/85	16/85	16/85	20/85	20/85					
Brick N° 1	0,9	1,5	1,5	1,5	1,5					
Brick N° 2	2,0	2,0	2,0	2,5	2,5					
Brick N° 3	3,0	3,0	3,0	3,0	3,0	3,5	4,0	5,0	3,5	4,5
Brick N° 4	3,0	3,0	3,0	3,0	3,0	6,0	7,0	8,0	5,5	8,0
Brick N° 5	2,0	2,0	2,0	2,5	2,5					

1) For design according TR 054: $N_{Rk} = N_{Rk,p} = N_{Rk,b} = N_{Rk,s}$; $N_{Rk,pb}$ according to TR 054
For $V_{Rk,s}$ see Annex C1, Table C2; Calculation of $V_{Rk,pb}$ and $V_{Rk,c}$ according to TR 054

Table C2: Characteristic resistance under shear loading – steel failure

Size			M6	M8	M10	M12	M16	Partial safety factor γ_{Ms}
Characteristic shear resistance								
KPG 5.8	$V_{Rk,s}$	[kN]	5	9	15	21	39	1,25
KPG 8.8	$V_{Rk,s}$	[kN]	8	15	23	34	63	1,25
KPG 10.9	$V_{Rk,s}$	[kN]	10	18	29	42	79	1,50
KPG A2-70, KPG A4-70	$V_{Rk,s}$	[kN]	7	13	20	30	55	1,56
KPG A4-80	$V_{Rk,s}$	[kN]	8	15	23	34	63	1,33
KPG HCR	$V_{Rk,s}$	[kN]	7	13	20	30	55	1,25
KPG UHCR	$V_{Rk,s}$	[kN]	7	13	20	30	55	1,56
Characteristic bending moment								
KPG 5.8	$M_{Rk,s}$	[N.m]	8	19	37	66	166	1,25
KPG 8.8	$M_{Rk,s}$	[N.m]	12	30	60	105	266	1,25
KPG 10.9	$M_{Rk,s}$	[N.m]	15	37	75	131	333	1,50
KPG A2-70, KPG A4-70	$M_{Rk,s}$	[N.m]	11	26	52	92	233	1,56
KPG A4-80	$M_{Rk,s}$	[N.m]	12	30	60	105	266	1,33
KPG HCR	$M_{Rk,s}$	[N.m]	11	26	52	92	233	1,25
KPG UHCR	$M_{Rk,s}$	[N.m]	11	26	52	92	233	1,56

Table C3: Displacements under tension and shear load

Base material	F [kN]	With sleeve				Without sleeve			
		δ_{N0} [mm]	$\delta_{N\infty}$ [mm]	δ_{V0} [mm]	$\delta_{V\infty}$ [mm]	δ_{N0} [mm]	$\delta_{N\infty}$ [mm]	δ_{V0} [mm]	$\delta_{V\infty}$ [mm]
Hollow clay brick	$N_{Rk} / (1,4 \cdot \gamma_M)$	0,5	1,0	1,0 1)	1,5 1)				
Solid clay brick	$N_{Rk} / (1,4 \cdot \gamma_M)$	0,06	0,12	0,7 1)	1,0 1)	0,3	0,6	0,7	1,1
Solid calcium silicate brick	$N_{Rk} / (1,4 \cdot \gamma_M)$	0,12	0,24	0,9 1)	1,4 1)	0,3	0,5	0,8	1,3
Perforated calcium silicate brick	$N_{Rk} / (1,4 \cdot \gamma_M)$	0,1	0,2	0,9 1)	1,4 1)				

1) the hole gap between bolt and fixture shall be considered additionally

Table C4: β - factors for job site tests according to TR 053

Brick N°	N° 1	N° 2	N° 3	N° 4	N° 5
β - factor	0,78	0,83	0,85	0,85	0,85

WCF-EASF, WCF-EASF-C, WCF-EASF-E for masonry

Performances
Characteristic resistance, displacement
β-factors for job site testing under tension load

Annex C 1

Table C5: Characteristic resistance under tension and shear loading
WCF-EASF-C with installation temperature < -10°C

Base material	Anchor rods with sleeve $N_{Rk} = V_{Rk}$ [kN] [1)]					Anchor rods without sleeve $N_{Rk} = V_{Rk}$ [kN] [1)]				
	M8	M10	M12	M12	M16	M6	M8	M10	M12	M16
Sleeve	16/85	16/85	16/85	20/85	20/85					
Brick N° 1	0,9	1,5	1,5	1,5	1,5					
Brick N° 2	2,0	2,0	2,0	2,5	2,5					
Brick N° 3	3,0	3,0	3,0	3,0	3,0	3,0	4,0	5,0	3,5	4,5
Brick N° 4	3,0	3,0	3,0	3,0	3,0	6,0	7,0	7,5	5,5	7,5
Brick N° 5	2,0	2,0	2,0	2,5	2,5					

[1)] For design according TR 054: $N_{Rk} = N_{Rk,p} = N_{Rk,b} = N_{Rk,s}$; $N_{Rk,pb}$ according to TR 054
For $V_{Rk,s}$ see Annex C1, Table C2; Calculation of $V_{Rk,pb}$ and $V_{Rk,c}$ according to TR 054

Table C6: Characteristic resistance under shear loading – steel failure

Size	M6	M8	M10	M12	M16	Partial safety factor γ_{Ms}
See Annex C 1						

Table C7: Displacements under tension and shear load

Base material	F [kN]	With sleeve				Without sleeve			
		δ_{N0} [mm]	$\delta_{N\infty}$ [mm]	δ_{V0} [mm]	$\delta_{V\infty}$ [mm]	δ_{N0} [mm]	$\delta_{N\infty}$ [mm]	δ_{V0} [mm]	$\delta_{V\infty}$ [mm]
See Annex C 1									

[1)] the hole gap between bolt and fixture shall be considered additionally

Table C8: β - factors for job site tests according to TR 053
WCF-EASF-C with installation temperature < -10°C

Brick N°	N° 1	N° 2	N° 3	N° 4	N° 5
β - factor	0,74	0,79	0,81	0,81	0,81

Table C9: Characteristic resistance under tension and shear loading

Base material	Anchor rods $N_{Rk} = V_{Rk}$ [kN] [1]									
	Use conditions d/d					Use conditions w/d and w/w				
	M6	M8	M10	M12	M16	M6	M8	M10	M12	M16
Brick N° 6	0,9	0,9	0,9	0,9	2,0	0,75	0,75	0,75	0,9	1,5
Brick N° 7	0,9	1,5	1,5	2,0	3,0	0,9	1,2	1,2	1,5	2,5
Brick N° 8	1,2	2,5	2,5	3,0	4,0	0,9	2,0	2,0	2,5	3,0
Brick N° 9	1,5	3,0	3,0	4,0	5,0	1,2	2,5	2,5	3,5	4,0
Brick N° 10	1,5	4,0	4,0	5,0	6,0	1,2	3,0	3,0	4,0	4,5

[1] For design according TR 054: $N_{Rk} = N_{Rk,p} = N_{Rk,b} = N_{Rk,s}$; $N_{Rk,pb}$ according to TR 054
For $V_{Rk,s}$ see Annex C 3, Table C10; Calculation of $V_{Rk,pb}$ and $V_{Rk,c}$ according to TR 054

Table C10: Characteristic resistance under shear loading – steel failure

Size			M6	M8	M10	M12	M16	Partial safety factor γ_{Ms}
Characteristic shear resistance								
KPG 4.6	$V_{Rk,s}$	[kN]	4	7	12	17	31	1,67
KPG 5.8	$V_{Rk,s}$	[kN]	5	9	15	21	39	1,25
KPG 8.8	$V_{Rk,s}$	[kN]	8	15	23	34	63	1,25
KPG 10.9	$V_{Rk,s}$	[kN]	10	18	29	42	79	1,50
KPG A2-70, KPG A4-70	$V_{Rk,s}$	[kN]	7	13	20	30	55	1,56
KPG A4-80	$V_{Rk,s}$	[kN]	8	15	23	34	63	1,33
KPG HCR	$V_{Rk,s}$	[kN]	7	13	20	30	55	1,25
KPG UHCR	$V_{Rk,s}$	[kN]	7	13	20	30	55	1,56
Characteristic bending moment								
KPG 4.6	$M_{Rk,s}$	[N.m]	6	15	30	52	133	1,67
KPG 5.8	$M_{Rk,s}$	[N.m]	8	19	37	66	166	1,25
KPG 8.8	$M_{Rk,s}$	[N.m]	12	30	60	105	266	1,25
KPG 10.9	$M_{Rk,s}$	[N.m]	15	37	75	131	333	1,50
KPG A2-70, KPG A4-70	$M_{Rk,s}$	[N.m]	11	26	52	92	233	1,56
KPG A4-80	$M_{Rk,s}$	[N.m]	12	30	60	105	266	1,33
KPG HCR	$M_{Rk,s}$	[N.m]	11	26	52	92	233	1,25
KPG UHCR	$M_{Rk,s}$	[N.m]	11	26	52	92	233	1,56

Table C11: Displacements under tension and shear load

Size			M6	M8	M10	M12	M16
Load	F	[kN]	$N_{Rk} / (1,4 \cdot \gamma_M)$				
AAC2	δ_{N0}	[mm]	0,27	0,24	0,32	0,39	0,96
	$\delta_{N\infty}$	[mm]	0,54	0,49	0,64	0,78	1,92
	δ_{V0}	[mm]	0,25	0,42	0,16	0,18	0,31
	$\delta_{V\infty}$	[mm]	0,38	0,62	0,23	0,27	0,46
AAC4	δ_{N0}	[mm]	0,64	0,24	0,32	0,39	0,96
	$\delta_{N\infty}$	[mm]	1,28	0,49	0,64	0,78	1,92
	δ_{V0}	[mm]	0,32	0,73	0,54	0,29	0,32
	$\delta_{V\infty}$	[mm]	0,47	1,09	0,81	0,44	0,48
AAC6	δ_{N0}	[mm]	0,64	0,06	0,09	0,10	0,05
	$\delta_{N\infty}$	[mm]	1,28	0,12	0,18	0,21	0,11
	δ_{V0}	[mm]	0,32	0,73	0,54	0,29	0,32
	$\delta_{V\infty}$	[mm]	0,47	1,09	0,81	0,44	0,48

[1] the hole gap between bolt and fixture shall be considered additionally

Table C12: β - factors for job site tests according to TR 053

Brick N°	N° 6	N° 7	N° 8	N° 9	N° 10
β - factor - Use conditions **d/d**	0,98	0,98	0,98	0,98	0,98
β - factor - Use conditions **d/w** and **w/w**	0,78	0,78	0,78	0,78	0,78

WCF-EASF, WCF-EASF-C, WCF-EASF-E for masonry

Performances
Characteristic resistance, displacement
β-factors for job site testing under tension load

Annex C 3

Table C13: Characteristic resistance under tension and shear loading
WCF-EASF-C with installation temperature < -10°C

Base material	Anchor rods $N_{Rk} = V_{Rk}$ [kN] [1)]									
	Use conditions d/d					Use conditions w/d and w/w				
	M6	M8	M10	M12	M16	M6	M8	M10	M12	M16
Brick N° 6	0,75	0,9	0,9	0,9	2,0	0,6	0,75	0,75	0,9	1,5
Brick N° 7	0,9	1,5	1,5	2,0	3,0	0,75	1,2	1,2	1,5	2,0
Brick N° 8	1,2	2,0	2,5	3,0	3,5	0,9	1,5	2,0	2,5	3,0
Brick N° 9	1,2	3,0	3,0	4,0	4,5	0,9	2,5	2,5	3,0	3,5
Brick N° 10	1,5	3,5	4,0	5,0	5,5	1,2	3,0	3,0	4,0	4,5

1) For design according TR 054: $N_{Rk} = N_{Rk,p} = N_{Rk,b} = N_{Rk,s}$; $N_{Rk,pb}$ according to TR 054
For $V_{Rk,s}$ see Annex C 3, Table C10; Calculation of $V_{Rk,pb}$ and $V_{Rk,c}$ according to TR 054

Table C14: Characteristic resistance under shear loading – steel failure

Size	M6	M8	M10	M12	M16	Partial safety factor γ_{Ms}
See Annex C 3						

Table C15: Displacements under tension and shear load

Size	M6	M8	M10	M12	M16
See Annex C 3					

1) the hole gap between bolt and fixture shall be considered additionally

Table C16: β - factors for job site tests according to TR 053
WCF-EASF-C with installation temperature < -10°C

Brick N°	N° 6	N° 7	N° 8	N° 9	N° 10
β - factor - Use conditions **d/d**	0,95	0,95	0,95	0,95	0,95
β - factor - Use conditions **d/w** and **w/w**	0,74	0,74	0,74	0,74	0,74