Deutsches Institut für Bautechnik

DIBt

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European Technical Assessment Body for construction products

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

European Technical Assessment ETA-25/0131 of 24 March 2025

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	CLR plus and CLR plus ZF
Product family to which the construction product belongs	Screw anchor for use in masonry
Manufacturer	Friulsider S.p.A. Via Trieste 1 33048 SAN GIOVANNI AL NATISONE (UD) ITALIEN
Manufacturing plant	Friulsider Plant
This European Technical Assessment contains	39 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 330460-00-0604, Edition 08/2022

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Specific Part

1 Technical description of the product

The CLR plus and CLR plus ZF is an anchor in size 5,6, 8 and 10 mm made of galvanised steel. The anchor is screwed into a predrilled cylindrical drill hole. The special thread of the anchor cuts an internal thread into the member while setting. The anchorage is characterized by mechanical interlock in the special thread.

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 anchors 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 steel failure of a single screw anchor under tension loading	$N_{Rk,s}$ see Annex C1
Characteristic resistance to steel failure of a single screw anchor under shear loading	$V_{Rk,s}$ [kN], $M^0_{Rk,s}$ see Annex C1
Characteristic resistance to pull-out failure or brick breakout failure of a single screw anchor under tension loading	$N_{Rk,p}$, $N_{Rk,b}$, $N_{Rk,p,c}$, $N_{Rk,b,c}$ see Annex B7, C4, C9, C14, C19, C23 $\alpha_{j,N}$ see Annex C3, C8, C13, C18, C23
Characteristic resistance to local brick failure and brick edge failure of a single screw anchor under shear loading	$V_{Rk,b,II}$, $V_{Rk,b,\perp}$, $V_{Rk,c,II}$, $V_{Rk,c,\perp}$ see Annex B7, C4, C9, C14, C19, C23 $\alpha_{j,VII}$, $\alpha_{j,V\perp}$ see Annex C3, C8, C13, C18, C23
Characteristic resistance to brick breakout failure of a screw anchor group under tension loading	N^g_{Rk} see Annex B7 $\alpha_{g,N}$ see Annex B7, C2, C8, C13, C18, C22
Characteristic resistance to local brick failure and brick edge failure of a screw anchor group under shear loading	$V^g_{Rk,b,II}$, $V^g_{Rk,b,\perp}$, $V^g_{Rk,c,II}$, $V^g_{Rk,c,\perp}$ see Annex B7 $\alpha_{g,VII}$, $\alpha_{g,VII\perp}$ see Annex B7, C2, C8, C13, C18, C22

Essential characteristic	Performance
Edge distances, joint distances, spacing, member thickness	c_{cr}, s_{crII}, $s_{cr\perp}$ see Annex B7 c_{min}, c_{jII}, $c_{j\perp}$, s_{minII}, $s_{min\perp}$ see Annex B7, C2, C8, C13, C18, C22 h_{min} see Annex C2, C7, C12, C17, C22
Resistance to combined tension and shear loading (hollow and perforated bricks)	Limit value X for interaction see Annex C14
Displacements	δ_{N0}, $\delta_{N\infty}$, δ_{V0}, $\delta_{V\infty}$ see Annex C5, C10, C15, C 20, C 24

3.2 Safety in case of fire (BWR 2)

Essential characteristic	Performance
Reaction to fire	Class A 1
Resistance to fire	$N_{Rk,s,fi}$, $N_{Rk,p,fi}$, $N_{Rk,b,fi}$, $V_{Rk,s,fi}$, $M^0_{Rk,s,fi}$, $c_{min,fi}$, $c_{j,fi}$ see Annex C6, C11, C16, C21 $N^g_{Rk,fi}$, $s_{min,fi}$, $c_{min,fi}$, $c_{j,fi}$ see Annex C5, C10, C15, C20

3.3 Aspects of durability

Essential characteristic	Performance
Durability	see Annex B1

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 330460-00-0604 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 24 March 2025 by Deutsches Institut für Bautechnik

Dipl.-Ing. Beatrix Wittstock
Head of Section

beglaubigt:
Aksünger

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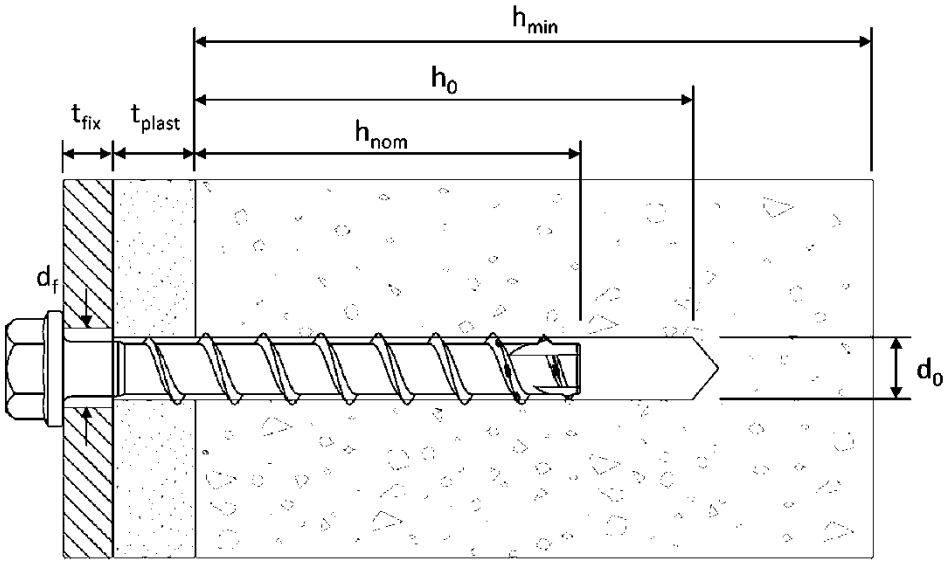
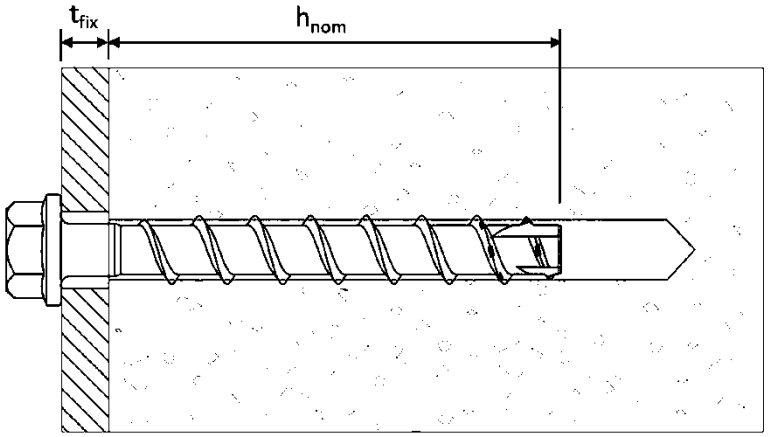
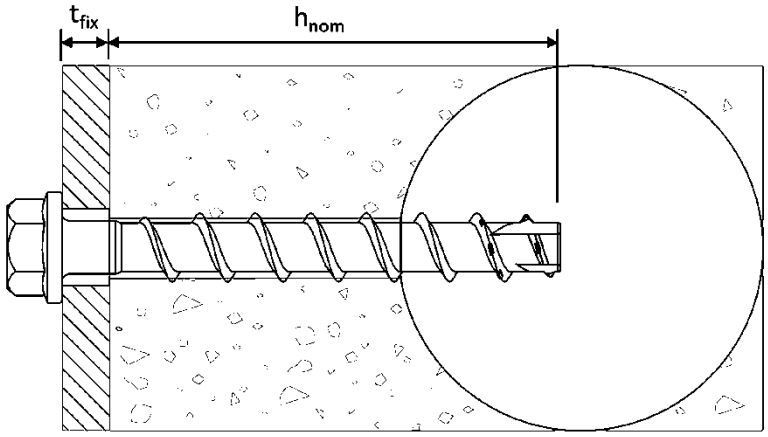
Product in installed condition



CLR plus in solid and perforated brick with non-load-bearing layer



CLR plus in solid brick



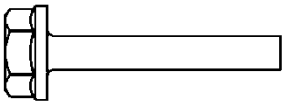
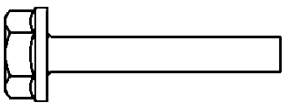
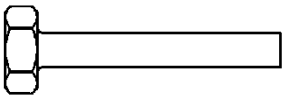
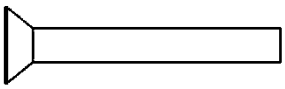
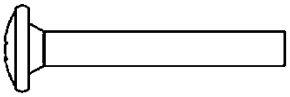
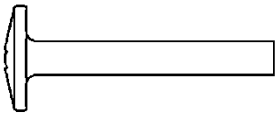
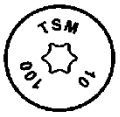
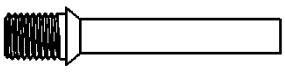
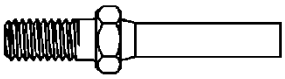
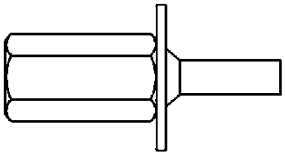
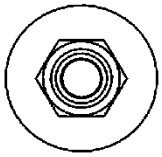
CLR plus in perforated brick

d_0 = nominal drill hole diameter
t_{fix} = thickness of fixture
d_f = clearance hole diameter
t_{plast} = thickness of non-load-bearing layer

h_{min} = minimum thickness of member
h_{nom} = nominal embedment depth
h_0 = drill hole depth

CLR plus and CLR plus ZF	
Product description Product in installed condition	**Annex A1**

Deutsches Institut für Bautechnik DIBt

 	Configuration with metric connection thread and hexagon drive, Type ST
 	Configuration with washer and hexagon head, Type H
 	Configuration with washer, hexagon head and TORX drive, Type H
 	Configuration with hexagon head, Type S
 	Configuration with countersunk head and TORX drive, SK
 	Configuration with pan head and TORX drive, Type P
 	Configuration with large pan head and TORX drive, Type P
 	Configuration with countersunk head and connection thread, Type ST-6
 	Configuration with hexagon drive and connection thread, Type ST-6
 	Configuration with internal thread and hexagon drive, Type I

CLR plus and CLR plus ZF	
Product description Screw types	**Annex A2**

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Table 1: Material

Part	Product name	Material
All types	CLR plus	Steel EN 10263-4:2017 galvanized acc. to EN ISO 4042:2018
	CLR plus ZF	Zinc flake coating according to EN ISO 10683:2018 (≥5µm)

Part	Product name	Nominal characteristic steel		Elongation
		Yield strength f_{yk} [N/mm²]	Ultimate strength f_{uk} [N/mm²]	A_5 [%]
All types	CLR plus, CLR plus ZF	560	700	≤ 8

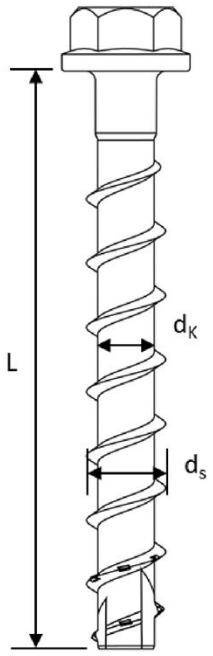
Table 2: Dimensions

CLR plus size			5	6		8		10	
Nominal embedment depth		h_{nom}	h_{nom1}	h_{nom1}	h_{nom2}	h_{nom1}	h_{nom2}	h_{nom1}	h_{nom2}
		[mm]	35	35	55	45	65	55	75
Screw length	≤ L	[mm]	500						
Core diameter	d_K	[mm]	4,0	5,1		7,1		9,1	
Thread outer diameter	d_s	[mm]	6,5	7,5		10,6		12,6	

Marking:

CLR plus

Screw type: TSM
Screw size: 10
Screw length: 100



CLR plus and CLR plus ZF

Product description
Material, dimensions and marking

Annex A3

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Specification of Intended use

Anchorages subject to:

- Static or quasi-static actions in tension, shear or combined tension and shear or bending
- Exposure to fire (for dry masonry only)

Base materials:

- Masonry made of solid bricks and perforated bricks see Annex B3
- Minimum thickness of member h_{min} see Annexes C2, C7, C12, C17, C22
- Bearing joints must be completely filled with mortar of at least compressive strength class M5 according to EN 998-2:2016. Butt joints may, but do not have to be filled with mortar.
- In case of fire, all joints must be completely filled with mortar according to EN 998-2:2016 with strength class at minimum M5
- Dry or wet masonry (during installation)

Use conditions (Environmental conditions):

- Concrete screws subject to dry internal conditions: all screw types.
- Temperature range of the masonry over the period of use: -40°C to +80°C

Design:

- The anchorage is designed in accordance with EOTA Technical Report TR 054:2022-07.
- Anchorages are to be designed under the responsibility of an engineer experienced in anchorages and masonry work.
- Screws with nominal embedment depth smaller than 50 mm may only be used for anchoring of statically indeterminate systems
- Verifiable calculation notes and drawings are to be 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 to supports, etc.).
- The screw may be placed in the wall side and in the reveal side of the masonry. The installation parameters for installation in the reveal side must be observed in accordance with Annex B8. In case of Silka XL solid calcium silicate brick KS 12DF, the installation is possible in the wall side only.
- For solid blocks, the characteristic load-bearing capacities also apply to larger block formats, greater compressive strengths and densities of the masonry blocks.
- Installation in the joint and close to the joint is not permitted; the distances to joints according annexes C3, C8, C13, C18, C23 must be observed.

CLR plus and CLR plus ZF	
Intended use Specification	**Annex B1**

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Specification of Intended use - continuation

Installation:

- Bridging of non-load-bearing layers (e.g. plaster) is possible. When selecting the screw length L, the thickness of the plaster layer t_{plast} must be taken into account. $L \geq h_{nom} + t_{plast} + t_{fix}$ (see figures in Annex A1)
- During installation, the joint, axis and edge distances specified by the planner must be taken into account.
- Anchor installation carried out by appropriately qualified personnel and under the supervision of the person responsible for technical matters on site
- The borehole is drilled with hammer, percussion, suction or masonry drills in hammer mode or rotary mode. The masonry must not be damaged during hammer drilling. If cracks occur during drilling, the rotary mode must be used. In this case, the drill hole must be discarded.
- Incorrectly drilled holes must be filled with high-strength mortar.

CLR plus and CLR plus ZF	
Intended use Specification continuation	**Annex B2**

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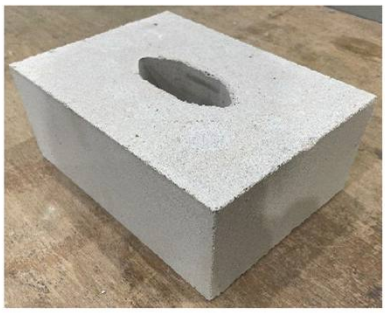
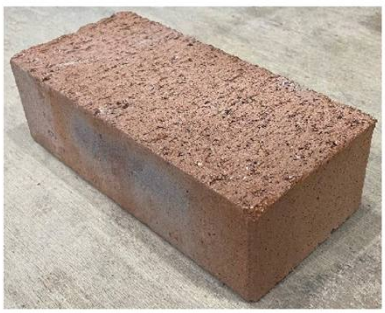
Table 3: Solid and perforated bricks, dimensions and properties

Solid calcium silicate brick KS acc. to DIN EN 771-2:2015-11				
Nomenclature	Dimensions [mm]	Mean compressive strength [N/mm²]	Bulk density [kg/dm³]	Annex
KS 20 - 2,0 - NF	L: ≥ 240 D: ≥ 115 H: ≥ 71	≥ 26,0	≥ 2,0	C2 – C6

Silka XL solid calcium silicate brick KS 12DF acc. to DIN EN 771-2:2015-11				
Nomenclature	Dimensions [mm]	Mean compressive strength [N/mm²]	Bulk density [kg/dm³]	Annex
KS - R (P) 20 - 2,0 - 12DF	L: ≥ 498 D: ≥ 175 H: ≥ 248	≥ 14,0	≥ 1,8	C7 – C11



Perforated calcium silicate brick KSL 3DF acc. to DIN EN 771-2:2015-11				
Nomenclature	Dimensions [mm]	Mean compressive strength [N/mm²]	Bulk density [kg/dm³]	Annex
SWKV KSL 12 - 1,6 - 3DF	L: ≥ 240 D: ≥ 175 H: ≥ 113	≥ 17,0	≥ 1,5	C12 - C16



Solid clay brick MZ acc. to DIN EN 771-1:2015-11				
Nomenclature	Dimensions [mm]	Mean compressive strength [N/mm²]	Bulk density [kg/dm³]	Annex
MZ 20 - 2,0 - NF	L: ≥ 240 D: ≥ 115 H: ≥ 71	≥ 21,0	≥ 2,1	C17 – C21

Solid light weight concrete brick acc. to DIN EN 771-3:2015-11				
Nomenclature	Dimensions [mm]	Mean compressive strength [N/mm²]	Bulk density [kg/dm³]	Annex
VBL 4 - 1,0 - 2DF	L: ≥ 240 D: ≥ 115 H: ≥ 113	≥ 4,0	≥ 1,5	C22 – C24

CLR plus and CLR plus ZF

Intended use
Solid and perforated bricks, dimensions and properties

Annex B3

Deutsches Institut für Bautechnik DIBt

Table 4: General installation parameters

CLR plus size			5	6		8		10	
Nominal embedment depth		h_{nom}	h_{nom1}	h_{nom1}	h_{nom2}	h_{nom1}	h_{nom2}	h_{nom1}	h_{nom2}
		[mm]	35	35	55	45	65	55	75
Nominal drill hole diameter	d_0	[mm]	5	6		8		10	
Cutting diameter of drill bit	$d_{cut} \leq$	[mm]	5,40	6,40		8,45		10,45	
Drill hole depth	$h_0 \geq$	[mm]	55	55	75	65	85	75	95
Clearance hole diameter	$d_f \leq$	[mm]	7	8		12		14	

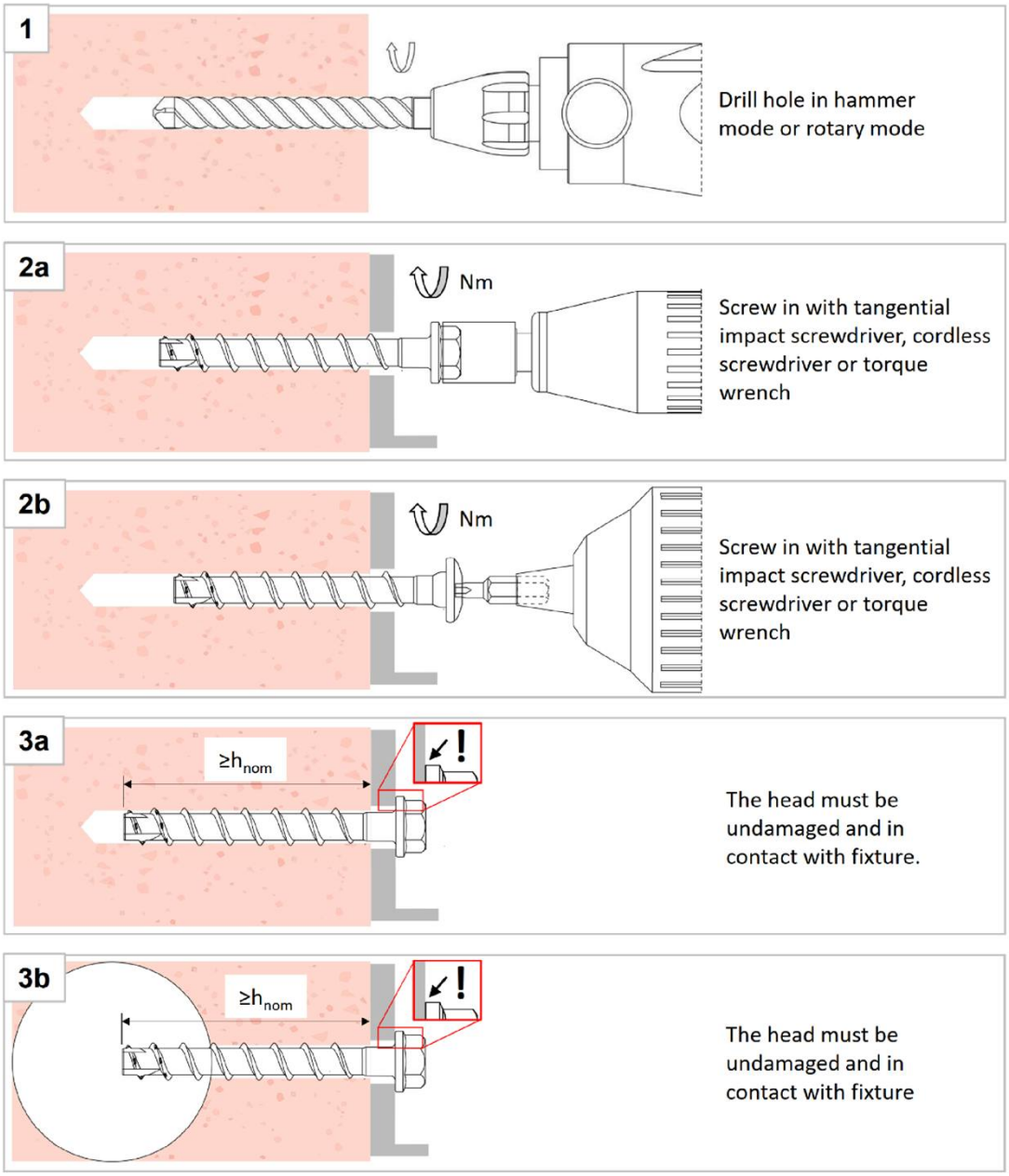
CLR plus and CLR plus ZF

Intended use
General installation parameters

Annex B4

Deutsches Institut für Bautechnik DIBt

Installation instructions



Note:

Step 1:	Joint distances, spacing and edge distances must be taken into account.
Step 2a + 2b:	For further details on screwing in, see brick type related Annex C2 – C24. The tightening torque must not exceed $T_{inst,max}$
Step 3a + 3b:	It must not be possible to turn the screw. $T_{inst,max}$ must not be exceeded during the check.

CLR plus and CLR plus ZF	
Intended use Installation Instructions	**Annex B5**

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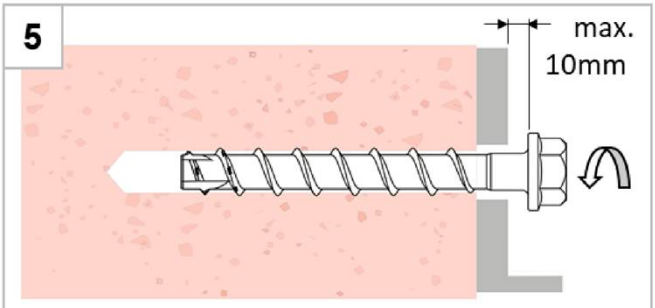
Installation Instructions - Adjustment

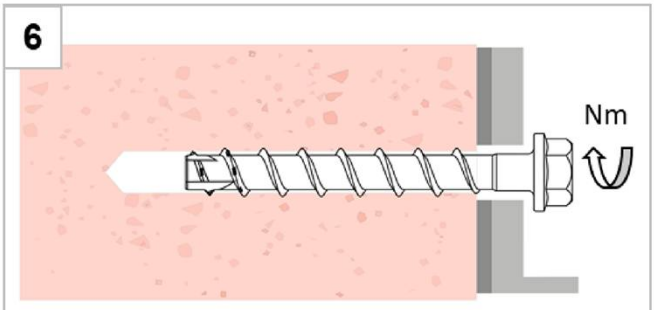
1. Adjustment

5



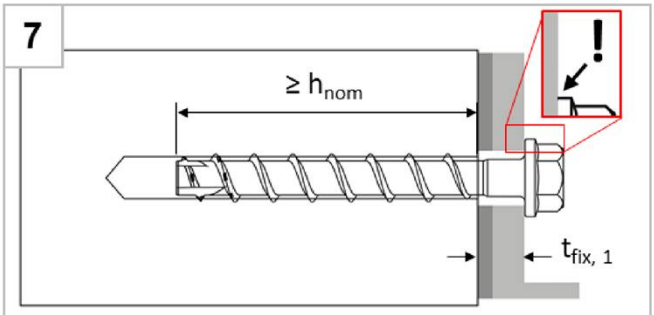
Screw may be untightened maximum 10mm.

6



After adjustment, the screw may be screwed in with a tangetial impact screwdriver, cordless screwdriver or torque wrench.

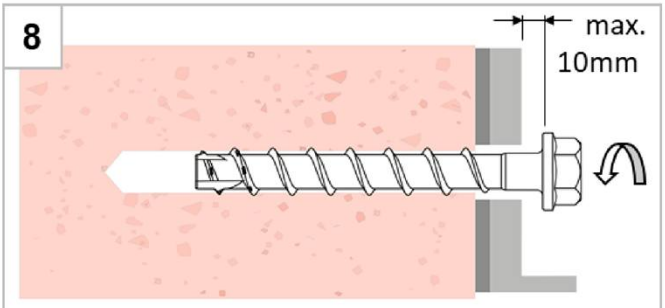
7



The head must be undamaged and in conctact with the fixture.

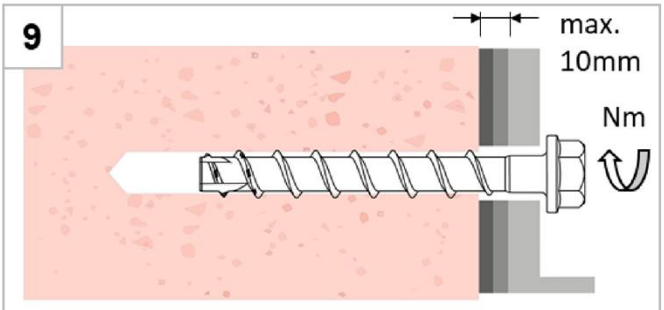
2. Adjustment

8



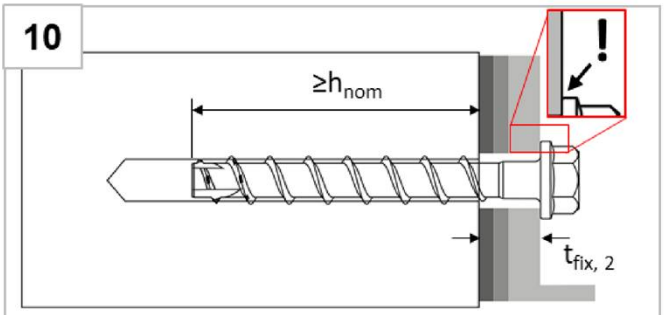
Screw may be untightened maximum 10mm.

9



After adjustment, the screw may be screwed in with a tangetial impact screwdriver, cordless screwdriver or torque wrench.

10



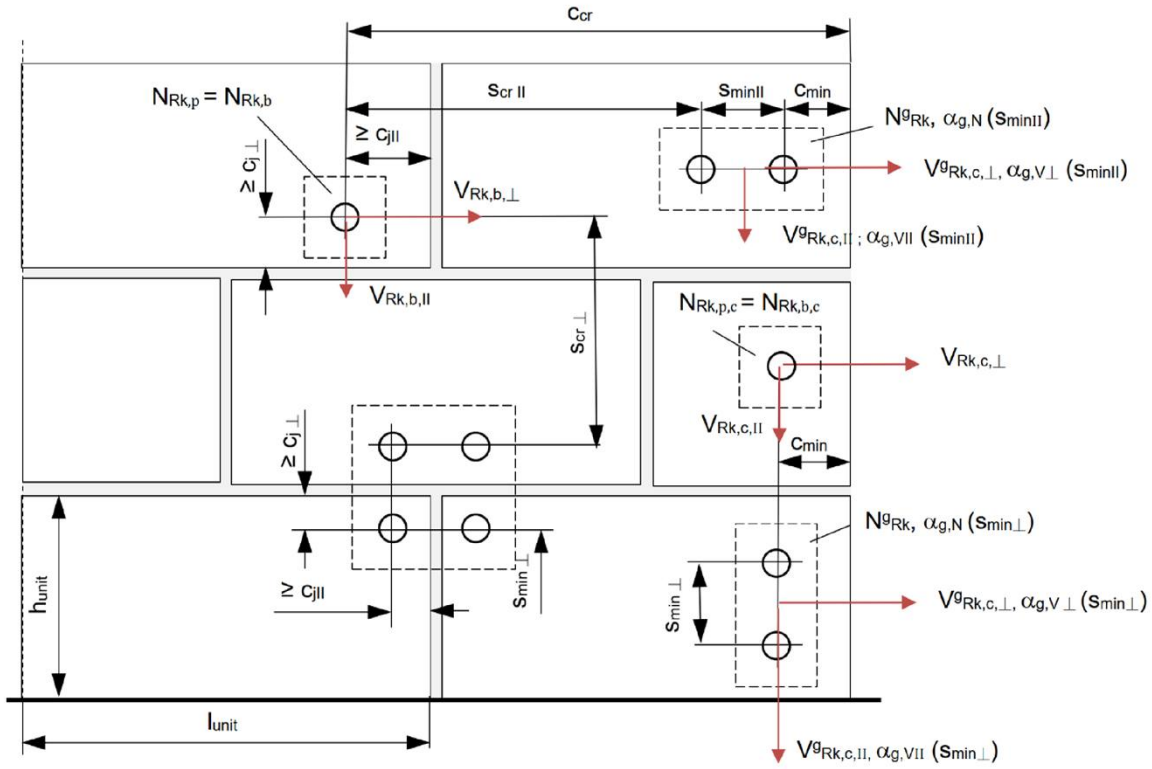
The head must be undamaged and in contact with the fixture.

Note:

1. The screw can be adjusted maximum two times. The total allowed thickness of shims added during the adjustment process is 10mm. The final embedment depth after adjustment process must be larger or equal than h_{nom}.
2. For further details on screwing in, see brick type-related annexes C2 – C24

CLR plus and CLR plus ZF	
Intended use Installation instruction – adjustment	**Annex B6**

Possible installation positions, the distance c_j must be observed



c_{min}	= minimum edge distance to the free edge of the wall
$c_{j\,\parallel}$	= distance to the vertical joints without influence on resistance of the screw anchor
$c_{j\,\perp}$	= distance to the horizontal joints without influence on resistance of the screw anchor
$s_{min\,\parallel}$	= minimum spacing parallel to horizontal joint
$s_{min\,\perp}$	= minimum spacing perpendicular to the horizontal joint
c_{cr}	= edge distance for transmission of the characteristic resistance of single screw anchor = $1{,}5h_{nom}$
$s_{cr\,\parallel}$	= characteristic spacing parallel to the horizontal joint = $3{,}0h_{nom}$
$s_{cr\,\perp}$	= characteristic spacing perpendicular to the horizontal joint = $3{,}0h_{nom}$
l_{unit}	= length of the masonry unit
h_{unit}	= height of the masonry unit
$\alpha_{g,N}(s_{min\,\parallel})$	= group factor under tension load for minimum spacing parallel to horizontal joint
$\alpha_{g,N}(s_{min\,\perp})$	= group factor under tension load for minimum spacing perpendicular to the horizontal joint
$\alpha_{g,V\parallel}$	= group factor under shear load parallel to the edge ($\alpha_{g,V\parallel} = \alpha_{g,V\parallel}(s_{min\,\parallel}) = \alpha_{g,V\parallel}(s_{min\,\perp})$)
$\alpha_{g,V\perp}$	= group factor under shear load perpendicular to the edge ($\alpha_{g,V\perp} = \alpha_{g,V\perp}(s_{min\,\parallel}) = \alpha_{g,V\perp}(s_{min\,\perp})$)

$N_{Rk} = N_{Rk,b} = N_{Rk,p} = N_{Rk,b,c} = N_{Rk,p,c}$
$V_{Rk,\perp} = V_{Rk,,b\perp} = V_{Rk,c\perp}$; $V_{Rk,\perp} = V_{Rk,,b\perp} = V_{Rk,c\perp}$

Für $s \geq s_{cr}$: $\alpha_{g,N}(s_{min\,\parallel}) = \alpha_{g,N}(s_{min\,\perp}) = \alpha_{g,V\parallel} = \alpha_{g,V\perp} = 2$
Für $s_{min} \leq s \leq s_{cr}$: $\alpha_{g,N}(s_{min\,\parallel})$; $\alpha_{g,N}(s_{min\,\perp})$; $\alpha_{g,V\parallel}$; $\alpha_{g,V\perp}$ according to installation parameters of brick in Annex C
$N^g_{Rk}(s_{min\,\parallel}) = \alpha_{g,N}(s_{min\,\parallel}) \times N_{Rk}$ (group of 2 anchors with minimum spacing parallel to horizontal joint)
$N^g_{Rk}(s_{min\,\perp}) = \alpha_{g,N}(s_{min\,\perp}) \times N_{Rk}$ (group of 2 anchors with minimum spacing perpendicular to horizontal joint)
$V^g_{Rk\,\parallel} = \alpha_{g,V\parallel} \times V_{Rk,\parallel}$; $V^g_{Rk,\perp} = \alpha_{g,V\perp} \times V_{Rk,\perp}$ (group of 2 anchors)
$N^g_{Rk} = \alpha_{g,N}(s_{min\,\parallel}) \times \alpha_{g,N}(s_{min\,\perp}) \times N_{Rk}$ (group of 4 anchors)
$V^g_{Rk\,\parallel} = \alpha_{g,V\parallel}^2 \times V_{Rk,\parallel}$; $V^g_{Rk,\perp} = \alpha_{g,V\perp}^2 \times V_{Rk,\perp}$ (group of 4 anchors)

CLR plus and CLR plus ZF	
Intended use Possible installation position	**Annex B7**

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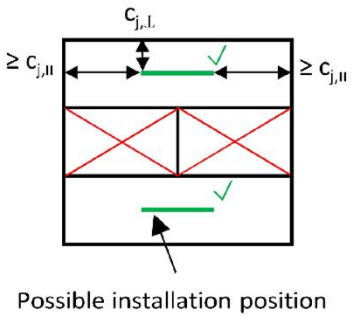
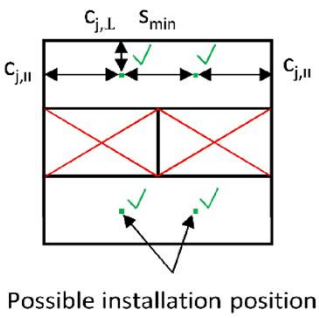
Installations parameter for installation in the reveal site

Positioning in reveal in brick types KS NF, MZ NF, VBL 2DF

Single anchor

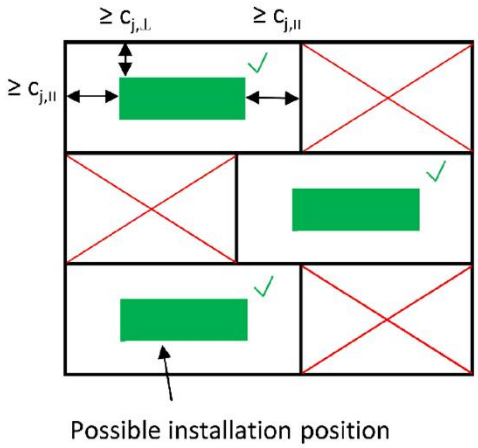


Double anchor group

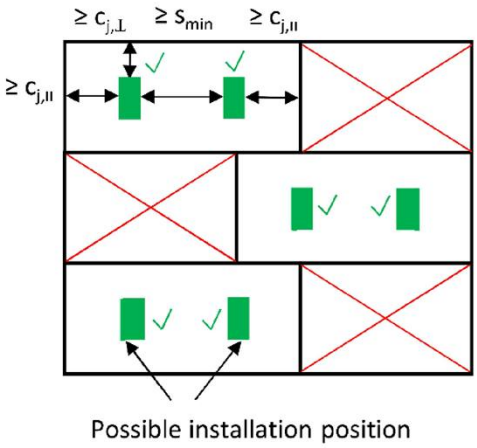


Positioning in reveal in brick type KSL 3DF

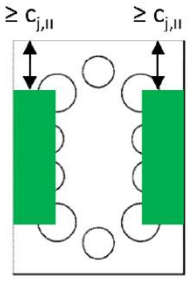
Single anchor



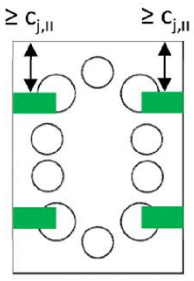
Double anchor group



Top view



Top view



CLR plus and CLR plus ZF	
Intended use Possible installation in reveal	**Annex B8**

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Table 5: Characteristic resistance to steel failure

CLR plus size			5	6		8		10	
Nominal embedment depth		h_{nom}	h_{nom1}	h_{nom1}	h_{nom2}	h_{nom1}	h_{nom2}	h_{nom1}	h_{nom2}
		[mm]	35	35	55	45	65	55	75
Steel failure for tension and shear loading									
Characteristic resistance under tension loading	$N_{Rk,s}$	[kN]	8,7	14,0		27,0		45,0	
Partial factor	$\gamma_{Ms,N}$ [1)]	[-]	1,5						
Characteristic resistance under shear loading	$V_{Rk,s}$	[kN]	4,4	7,0		13,5	17,0	22,5	34,0
Partial factor	$\gamma_{Ms,V}$ [1)]	[-]	1,25						
Characteristic bending moment	$M^0_{Rk,s}$	[Nm]	5,3	10,9		26,0		56,0	

[1)] In absence of other national regulations

Table 6: Material characteristics solid calcium silicate brick KS

Solid calcium silicate brick KS acc. to DIN EN 771-2:2015-11				
Nomenclature	Dimensions [mm]	Mean compressive strength [N/mm²]	Bulk density [kg/dm³]	Min. wall thickness h_{min} [mm]
KS 20 - 2,0 - NF	L: ≥ 240 D: ≥ 115 H: ≥ 71	≥ 26,0	≥ 2,0	240

Table 7: Installation parameters solid calcium silicate brick KS

Use category (installation)			dry or wet						
CLR plus size			5	6		5		8	
Nominal embedment depth		h_{nom}	h_{nom1}	h_{nom1}	h_{nom2}	h_{nom1}	h_{nom2}	h_{nom1}	h_{nom2}
		[mm]	35	35	55	45	65	55	75
Nominal drill hole diameter	d_0	[mm]	5	6		8		10	
Cutting diameter of drill bit	$d_{cut} \leq$	[mm]	5,40	6,40		8,45		10,45	
Drill hole depth	$h_0 \geq$	[mm]	55	55	75	65	85	75	95
Clearance hole diameter	$d_f \leq$	[mm]	7	8		12		14	
Torque for manual installation	max. T_{inst}	[Nm]	6	11		27		37	46
Impact screw driver	$T_{imp,max}$	[Nm]	Max. torque according to the manufacturer's instructions						
			185			300			

Table 8: Min. edge distance, spacing, group factors

CLR plus size			5	6		8		10	
Nominal embedment depth		h_{nom}	h_{nom1}	h_{nom1}	h_{nom2}	h_{nom1}	h_{nom2}	h_{nom1}	h_{nom2}
		[mm]	35	35	55	45	65	55	75
Min. edge distance	c_{min}	[mm]	80						
Min. spacing	$s_{min,II} = s_{min,\perp}$	[mm]	80						
Group factors	$\alpha_{g,N}$ ($s_{min,II}$)	[-]	1,65	1,70	1,05	1,15	1,15	1,05	1,65
	$\alpha_{g,N}$ ($s_{min,\perp}$)	[-]	1,55	1,70	1,05	1,15	1,20	1,10	1,20
	$\alpha_{g,V,II}$	[-]	1,55	1,55	1,35	1,15	1,05	1,05	1,35
	$\alpha_{g,V,\perp}$	[-]	1,30						

CLR plus and CLR plus ZF

Performances
Solid calcium silicate brick KS – material characteristics, installation parameters, min. edge distance and spacing, group factors

Annex C2

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Table 9: Reduction factors depending on the distance to joints

CLR plus size			5	6	8	10
Distance to joints	$c_{j\perp}$	[mm]	≥35			
	$c_{j\parallel}$		≥80			
Reduction factor	$\alpha_{j,N}$	[-]	1 (full resistance)			
	$\alpha_{j,V\parallel} = \alpha_{j,V\perp}$					
Distance to joints	$c_{j\perp}$	[mm]	<35			
	$c_{j\parallel}$		<80			
Reduction factor	$\alpha_{j,N}$	[-]	Screw must not be used			

CLR plus and CLR plus ZF

Performances
Solid calcium silicate brick KS – installation parameters close to the joints

Annex C3

Deutsches Institut für Bautechnik DIBt

Table 10: Characteristic resistances

Use category (installation)			dry or wet						
CLR plus size			5	6		8		10	
Nominal embedment depth		h_{nom}	h_{nom1}	h_{nom1}	h_{nom2}	h_{nom1}	h_{nom2}	h_{nom1}	h_{nom2}
		[mm]	35	35	55	45	65	55	75
Compressive strength f_{mean}	[N/mm²]		≥ 26,0						
Characteristic resistance to tension load	N_{Rk}	[kN]	3,5	3,1	4,9	4,1	4,3	3,8	4,5
Characteristic resistance to shear load	$V_{Rk,II}$	[kN]	5,3	5,3	8,6	6,3	11,3	7,7	13,0
	$V_{Rk,,\perp}$	[kN]	3,3						
Compressive strength f_{mean}	[N/mm²]		≥ 30,0						
Characteristic resistance to tension load	N_{Rk}	[kN]	3,7	3,4	5,3	4,4	4,6	4,0	4,8
Characteristic resistance to shear load	$V_{Rk,II}$	[kN]	5,7	5,7	9,3	6,7	12,1	8,3	13,9
	$V_{Rk,\perp}$	[kN]	3,5						
Compressive strength f_{mean}	[N/mm²]		≥ 35,0						
Characteristic resistance to tension load	N_{Rk}	[kN]	4,0	3,7	5,7	4,8	5,0	4,4	5,2
Characteristic resistance to shear load	$V_{Rk,II}$	[kN]	6,1	6,1	10,0	7,3	13,1	8,9	15,0
	$V_{Rk,\perp}$	[kN]	3,8						
Compressive strength f_{mean}	[N/mm²]		≥ 38,0						
Characteristic resistance to tension load	N_{Rk}	[kN]	4,2	3,8	6,0	5,0	5,2	4,5	5,4
Characteristic resistance to shear load	$V_{Rk,II}$	[kN]	6,4	6,4	10,4	7,6	13,7	9,3	15,7
	$V_{Rk,\perp}$	[kN]	4,0						

CLR plus and CLR plus ZF

Performance
Solid calcium silicate brick KS – characteristic resistances

Annex C4

Table 11: Displacements

Use category (installation)			dry or wet						
CLR plus size			5	6		8		10	
Nominal embedment depth		h_{nom}	h_{nom1}	h_{nom1}	h_{nom2}	h_{nom1}	h_{nom2}	h_{nom1}	h_{nom2}
		[mm]	35	35	55	45	65	55	75
Tension load	F_N	[kN]	1,00	0,89	1,40	1,17	1,23	1,09	1,29
Displacement in tension direction	δ_{N0}	[mm]	0,02	0,04	0,04	0,04	0,03	0,02	0,01
	$\delta_{N\infty}$	[mm]	0,03	0,08	0,08	0,07	0,05	0,04	0,03
Shear load parallel to the edge	$F_{V,II}$	[kN]	1,51	1,51	2,46	1,80	3,23	2,20	3,71
Displacement in shear direction parallel to the edge	$\delta_{V0,II}$	[mm]	0,93	0,09	1,51	0,52	1,00	0,22	0,98
	$\delta_{V\infty,II}$	[mm]	1,40	0,13	2,26	0,78	1,50	0,33	1,46
Shear load perpendicular to the edge	$F_{V,\perp}$	[kN]	0,94						
Displacement in shear direction perpendicular to the edge	$\delta_{V0,\perp}$	[mm]	0,22			0,03		0,02	
	$\delta_{V\infty,\perp}$	[mm]	0,33			0,05		0,03	

Table 12: Performance under fire exposure for anchor groups

CLR plus size			5	6		8		10	
Nominal embedment depth		h_{nom}	h_{nom1}	h_{nom1}	h_{nom2}	h_{nom1}	h_{nom2}	h_{nom1}	h_{nom2}
		[mm]	35	35	55	45	65	55	75
Characteristic resistance to local brick failure of groups under fire exposure									
$N^g_{Rk,fi} = N^g_{Rk,b,fi} = N^g_{Rk,p,fi}$	[kN]	R30-R90	$0{,}09 \cdot N^g_{Rk,b}$	$0{,}09 \cdot N^g_{Rk,b}$	$0{,}15 \cdot N^g_{Rk,b}$	$0{,}12 \cdot N^g_{Rk,b}$	$0{,}18 \cdot N^g_{Rk,b}$	$0{,}15 \cdot N^g_{Rk,b}$	$0{,}24 \cdot N^g_{Rk,b}$
		R120	$0{,}08 \cdot N^g_{Rk,b}$	$0{,}08 \cdot N^g_{Rk,b}$	$0{,}12 \cdot N^g_{Rk,b}$	$0{,}10 \cdot N^g_{Rk,b}$	$0{,}15 \cdot N^g_{Rk,b}$	$0{,}12 \cdot N^g_{Rk,b}$	$0{,}19 \cdot N^g_{Rk,b}$
Min. edge distance and spacing	[mm]	$c_{min,fi} = c_{j,fi}$	$2 \times h_{nom}$ [1)]						
		$s_{min,fi}$	107						

[1)] At least the distances set out in Table 13 shall be observed

CLR plus and CLR plus ZF

Performances
Solid calcium silicate brick KS – displacements and performance under fire exposure for anchor groups

Annex C5

Deutsches Institut für Bautechnik DIBt

Table 13: Fire exposure – Characteristic resistance

CLR plus size				5	6		8		10	
Nominal embedment depth			h_{nom}	h_{nom1}	h_{nom1}	h_{nom2}	h_{nom1}	h_{nom2}	h_{nom1}	h_{nom2}
			[mm]	35	35	55	45	65	55	75
Steel failure for tension and shear load										
Characteristic resistance	R30	$N_{Rk,s,fi30}$	[kN]	1,3	1,3	1,3	1,3	1,3	3,4	3,4
	R60	$N_{Rk,s,fi60}$	[kN]	1,0	1,0	1,0	1,0	1,0	2,7	2,7
	R90	$N_{Rk,s,fi90}$	[kN]	0,6	0,6	0,6	0,6	0,6	2,0	2,0
	R120	$N_{Rk,s,fi120}$	[kN]	0,5	0,5	0,5	0,5	0,5	1,7	1,7
	R30	$V_{Rk,s,fi30}$	[kN]	1,3	1,3	1,3	1,3	1,3	3,4	3,4
	R60	$V_{Rk,s,fi60}$	[kN]	1,0	1,0	1,0	1,0	1,0	2,7	2,7
	R90	$V_{Rk,s,fi90}$	[kN]	0,6	0,6	0,6	0,6	0,6	2,0	2,0
	R120	$V_{Rk,s,fi120}$	[kN]	0,5	0,5	0,5	0,5	0,5	1,7	1,7
	R30	$M^0_{Rk,s,fi30}$	[Nm]	0,8	1,1	1,1	1,5	1,5	4,9	4,9
	R60	$M^0_{Rk,s,fi60}$	[Nm]	0,5	0,8	0,8	1,1	1,1	4,0	4,0
	R90	$M^0_{Rk,s,fi90}$	[Nm]	0,3	0,5	0,5	0,8	0,8	3,0	3,0
	R120	$M^0_{Rk,s,fi120}$	[Nm]	0,2	0,4	0,4	0,6	0,6	2,5	2,5
Pull-out failure										
Characteristic resistance	R30	$N_{Rk,p,fi30}$	[kN]	1,1	1,3	1,3	1,3	1,3	3,4	3,4
	R60	$N_{Rk,p,fi60}$	[kN]	0,8	1,0	1,0	1,0	1,0	2,7	2,7
	R90	$N_{Rk,p,fi90}$	[kN]	0,5	0,6	0,6	0,6	0,6	2,0	2,0
	R120	$N_{Rk,p,fi120}$	[kN]	0,3	0,5	0,5	0,5	0,5	1,7	1,7
Breakout failure										
Characteristic resistance	R30	$N_{Rk,b,fi30}$	[kN]	1,1	1,3	1,3	1,3	1,3	3,4	3,4
	R60	$N_{Rk,b,fi60}$	[kN]	0,8	1,0	1,0	1,0	1,0	2,7	2,7
	R90	$N_{Rk,b,fi90}$	[kN]	0,5	0,6	0,6	0,6	0,6	2,0	2,0
	R120	$N_{Rk,b,fi120}$	[kN]	0,3	0,5	0,5	0,5	0,5	1,7	1,7
Edge and joint distance										
R30 - R120		$c_{min,fi} = c_{j,fi,II}$	[mm]	120						
		$c_{j,fi,\perp}$	[mm]	35						
Spacing										
R30 - R120		$s_{cr,fi}$	[mm]	$4 \times h_{nom}$						

CLR plus and CLR plus ZF

Performances
Solid calcium silicate brick KS – characteristic resistance under fire exposure

Annex C6

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Table 14: Material characteristics Silka XL solid calcium silicate brick KS 12DF

Silka XL solid calcium silicate brick KS 12DF acc. to DIN EN 771-2:2015-11				
Nomenclature	Dimensions [mm]	Mean compressive strength [N/mm²]	Bulk density [kg/dm³]	Min. wall thickness h_{min} [mm]
KS - R (P) 20 - 2,0 - 12DF	L: ≥ 498 D: ≥ 175 H: ≥ 248	≥ 14,0	≥ 1,8	175

Table 15: Installation parameters Silka XL solid calcium silicate brick KS 12DF

Use category (installation)			dry or wet							
CLR plus size			5	6		8		10		
Nominal embedment depth		h_{nom}	h_{nom1}	h_{nom1}	h_{nom2}	h_{nom1}	h_{nom2}	h_{nom1}	h_{nom2}
		[mm]	35	35	55	45	65	55	75
Nominal drill hole diameter	d_0	[mm]	5	6		8		10	
Cutting diameter of drill bit	$d_{cut} \leq$	[mm]	5,40	6,40		8,45		10,45	
Drill hole depth	$h_0 \geq$	[mm]	55	55	75	65	85	75	95
Clearance hole diameter	$d_f \leq$	[mm]	7	8		12		14	
Torque for manual installation	max. T_{inst}	[Nm]	6	10		25		45	
Torque for rotary screwdriver installation	$T_{imp,max}$	[Nm]	8	10	No performance assessed				
Impact screw driver	$T_{imp,max}$	[Nm]	Max. torque according to the manufacturer's instructions						
			No performance assessed		185	300			

CLR plus and CLR plus ZF

Performances
Silka XL solid calcium silicate brick KS 12DF – material characteristics, installation parameters

Annex C7

Table 16: Min edge distance, spacing, group factors

CLR plus size			5	6		8		10	
Nominal embedment depth		h_{nom}	h_{nom1}	h_{nom1}	h_{nom2}	h_{nom1}	h_{nom2}	h_{nom1}	h_{nom2}
		[mm]	35	35	55	45	65	55	75
Min. edge distance	c_{min}	[mm]	80						
Min. spacing	$s_{min,II} = s_{min,\perp}$	[mm]	80						
Group factors	$\alpha_{g,N}$ ($s_{min\,II}$)	[-]	1,65	1,65	1,75	1,40	1,40	1,60	1,30
	$\alpha_{g,N}$ ($s_{min\,\perp}$)	[-]	1,30	1,30	1,80	1,25	1,25	1,40	1,25
	$\alpha_{g,V,II}$	[-]	2,00	2,00	1,65	2,00	1,65	1,40	1,40
	$\alpha_{g,V,\perp}$	[-]	2,00	2,00	1,45	2,00	1,10	1,40	1,05

Table 17: Reduction factors depending on the distance to joints

CLR plus size			5	6	8	10
Distance to joints	$c_{j\,\perp}$	[mm]	≥40			
	$c_{j\,II}$		≥80			
Reduction factor	$\alpha_{j,N}$	[-]	1 (full resistance)			
	$\alpha_{j,VII} = \alpha_{j,V\perp}$					
Distance to joints	$c_{j\,\perp}$	[mm]	<40			
	$c_{j\,II}$		<40			
Reduction factor	$\alpha_{j,N}$	[-]	Screw must not be used			

CLR plus and CLR plus ZF

Performances
Silka XL solid calcium silicate brick KS 12DF – min. edge distance and spacing, group factors group factors and installation parameters close to the joints

Annex C8

Deutsches Institut für Bautechnik DIBt

Table 18: Characteristic resistances

Use category (installation)			dry or wet						
CLR plus size			5	6		8		10	
Nominal embedment depth		h_{nom}	h_{nom1}	h_{nom1}	h_{nom2}	h_{nom1}	h_{nom2}	h_{nom1}	h_{nom2}
		[mm]	35	35	55	45	65	55	75
Compressive strength f_{mean}	[N/mm²]		≥ 14,0						
Characteristic resistance to tension load	N_{Rk}	[kN]	2,3	2,3	4,1	6,3	6,3	6,4	6,7
Characteristic resistance to shear load	$V_{Rk,II}$	[kN]	3,2	3,2	9,7	3,2	9,7	17,4	17,4
	$V_{Rk,\perp}$	[kN]	3,6	3,6	8,3	3,6	7,5	5,9	9,8
Compressive strength f_{mean}	[N/mm²]		≥ 15,0						
Characteristic resistance to tension load	N_{Rk}	[kN]	2,4	2,4	4,3	6,5	6,5	6,6	6,9
Characteristic resistance to shear load	$V_{Rk,II}$	[kN]	3,3	3,3	10,1	3,3	10,1	18,0	18,0
	$V_{Rk,\perp}$	[kN]	3,7	3,7	8,6	3,7	7,8	6,1	10,1
Compressive strength f_{mean}	[N/mm²]		≥ 20,0						
Characteristic resistance to tension load	N_{Rk}	[kN]	2,8	2,8	4,9	7,5	7,5	7,6	8,0
Characteristic resistance to shear load	$V_{Rk,II}$	[kN]	3,8	3,8	11,7	3,8	11,7	20,8	20,8
	$V_{Rk,\perp}$	[kN]	4,3	4,3	9,9	4,3	9,0	7,0	11,7

CLR plus and CLR plus ZF

Performances
Silka XL solid calcium silicate brick KS 12DF – characteristic resistances

Annex C9

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Table 19: Displacements

Use category (installation)			dry or wet						
CLR plus size			5	6		8		10	
Nominal embedment depth		h_{nom}	h_{nom1}	h_{nom1}	h_{nom2}	h_{nom1}	h_{nom2}	h_{nom1}	h_{nom2}
		[mm]	35	35	55	45	65	55	75
Tension load	F_N	[kN]	0,66	0,66	1,17	1,80	1,80	1,83	1,91
Displacement in tension direction	δ_{N0}	[mm]	0,02	0,02	0,04	0,01	0,01	0,01	0,02
	$\delta_{N\infty}$	[mm]	0,04	0,04	0,08	0,02	0,02	0,02	0,05
Shear load parallel to the edge	$F_{V,II}$	[kN]	0,91	0,91	2,77	0,91	2,77	4,97	4,97
Displacement in shear direction parallel to the edge	$\delta_{V0,II}$	[mm]	0,98	0,98	3,00	0,98	3,00	2,95	2,95
	$\delta_{V\infty,II}$	[mm]	1,47	1,47	4,50	1,47	4,50	4,42	4,42
Shear load perpendicular to the edge	$F_{V,\perp}$	[kN]	1,03	1,03	2,37	1,03	2,14	1,69	2,80
Displacement in shear direction perpendicular to the edge	$\delta_{V0,\perp}$	[mm]	0,42	0,42	0,03	0,42	1,00	0,05	0,44
	$\delta_{V\infty,\perp}$	[mm]	0,63	0,63	0,05	0,63	1,50	0,08	0,66

Table 20: Performance under fire exposure for anchor groups

CLR plus size			5	6		8		10	
Nominal embedment depth		h_{nom}	h_{nom1}	h_{nom1}	h_{nom2}	h_{nom1}	h_{nom2}	h_{nom1}	h_{nom2}
		[mm]	35	35	55	45	65	55	75
Characteristic resistance to local brick failure of groups under fire exposure									
$N^g_{Rk,fi} = N^g_{Rk,b,fi} = N^g_{Rk,p,fi}$	[kN]	R30-R90	$0,09 \cdot N^g_{Rk,b}$	$0,09 \cdot N^g_{Rk,b}$	$0,15 \cdot N^g_{Rk,b}$	$0,12 \cdot N^g_{Rk,b}$	$0,18 \cdot N^g_{Rk,b}$	$0,15 \cdot N^g_{Rk,b}$	$0,24 \cdot N^g_{Rk,b}$
		R120	$0,08 \cdot N^g_{Rk,b}$	$0,08 \cdot N^g_{Rk,b}$	$0,12 \cdot N^g_{Rk,b}$	$0,10 \cdot N^g_{Rk,b}$	$0,15 \cdot N^g_{Rk,b}$	$0,12 \cdot N^g_{Rk,b}$	$0,19 \cdot N^g_{Rk,b}$
Min. edge distance and spacing	[mm]	$c_{min,fi} = c_{j,fi}$	$2 \times h_{nom}$ [1)]						
		$s_{min,fi}$	107						

[1)] At least the distances set out in Table 21 shall be observed

CLR plus and CLR plus ZF

Performances
Silka XL solid calcium silicate brick KS 12DF – displacements and performance under fire exposure for anchor groups

Annex C10

Table 21: Fire exposure – Characteristic resistance

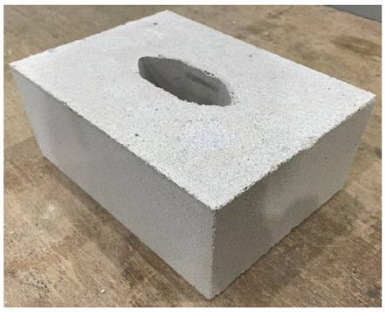
CLR plus size				5	6		8		10	
Nominal embedment depth			h_{nom}	h_{nom1}	h_{nom1}	h_{nom2}	h_{nom1}	h_{nom2}	h_{nom1}	h_{nom2}
			[mm]	35	35	55	45	65	55	75
Steel failure for tension and shear load										
Characteristic resistance	R30	$N_{Rk,s,fi30}$	[kN]	1,1	1,5	1,5	1,3	1,3	3,4	3,4
	R60	$N_{Rk,s,fi60}$	[kN]	0,8	1,1	1,1	1,0	1,0	2,7	2,7
	R90	$N_{Rk,s,fi90}$	[kN]	0,5	0,6	0,6	0,6	0,6	2,0	2,0
	R120	$N_{Rk,s,fi120}$	[kN]	0,3	0,4	0,4	0,5	0,5	1,7	1,7
	R30	$V_{Rk,s,fi30}$	[kN]	1,1	1,5	1,5	1,3	1,3	3,4	3,4
	R60	$V_{Rk,s,fi60}$	[kN]	0,8	1,1	1,1	1,0	1,0	2,7	2,7
	R90	$V_{Rk,s,fi90}$	[kN]	0,5	0,6	0,6	0,6	0,6	2,0	2,0
	R120	$V_{Rk,s,fi120}$	[kN]	0,3	0,4	0,4	0,5	0,5	1,7	1,7
	R30	$M^0_{Rk,s,fi30}$	[Nm]	0,8	1,2	1,2	1,5	1,5	4,9	4,9
	R60	$M^0_{Rk,s,fi60}$	[Nm]	0,5	0,9	0,9	1,1	1,1	4,0	4,0
	R90	$M^0_{Rk,s,fi90}$	[Nm]	0,3	0,5	0,5	0,8	0,8	3,0	3,0
	R120	$M^0_{Rk,s,fi120}$	[Nm]	0,2	0,3	0,3	0,6	0,6	2,5	2,5
Pull-out failure										
Characteristic resistance	R30	$N_{Rk,p,fi30}$	[kN]	1,1	0,4	0,72	1,3	1,3	3,4	3,4
	R60	$N_{Rk,p,fi60}$	[kN]	0,8	0,4	0,72	1,0	1,0	2,7	2,7
	R90	$N_{Rk,p,fi90}$	[kN]	0,5	0,4	0,72	0,6	0,6	2,0	2,0
	R120	$N_{Rk,p,fi120}$	[kN]	0,3	0,32	0,57	0,5	0,5	1,7	1,7
Breakout failure										
Characteristic resistance	R30	$N_{Rk,b,fi30}$	[kN]	1,1	0,28	0,79	1,3	1,3	3,4	3,4
	R60	$N_{Rk,b,fi60}$	[kN]	0,8	0,28	0,79	1,0	1,0	2,7	2,7
	R90	$N_{Rk,b,fi90}$	[kN]	0,5	0,28	0,79	0,6	0,6	2,0	2,0
	R120	$N_{Rk,b,fi120}$	[kN]	0,3	0,23	0,63	0,5	0,5	1,7	1,7
Edge and joint distance										
R30 - R120		$c_{min,fi} = c_{j,fi,II}$	[mm]	120						
		$c_{j,fi,\perp}$	[mm]	35						
Spacing										
R30 - R120		$s_{cr,fi}$	[mm]	$4 \times h_{nom}$						

CLR plus and CLR plus ZF

Performances
Silka XL solid calcium silicate brick KS 12DF - characteristic resistance under fire exposure

Annex C11

Table 22: Material characteristics perforated calcium silicate brick KSL 3DF



Perforated calcium silicate brick KSL 3DF acc. to DIN EN 771-2:2015-11				
Nomenclature	Dimensions [mm]	Mean compressive strength [N/mm²]	Bulk density [kg/dm³]	Min. wall thickness h_{min} [mm]
SWKV KSL 12 - 1,6 - 3DF	L: ≥ 240 D: ≥ 175 H: ≥ 113	≥ 17,0	≥ 1,5	175

Table 23: Installation parameters perforated calcium silicate brick KSL 3DF

Use category (installation)			dry or wet							
CLR plus size			5	6		8		10		
Nominal embedment depth		h_{nom}	h_{nom1}	h_{nom1}	h_{nom2}	h_{nom1}	h_{nom2}	h_{nom1}	h_{nom2}
		[mm]	35	35	55	45	65	55	75
Nominal drill hole diameter	d_0	[mm]	5	6		8		10	
Cutting diameter of drill bit	$d_{cut} \leq$	[mm]	5,40	6,40		8,45		10,45	
Drill hole depth	$h_0 \geq$	[mm]	55	55	75	65	85	75	95
Clearance hole diameter	$d_f \leq$	[mm]	7	8		12		14	
Torque for manual installation	max. T_{inst}	[Nm]	3	4		9		9	
Torque for rotary screwdriver installation	$T_{imp,max}$	[Nm]	9	11	No performance assessed				
Impact screw driver	$T_{imp,max}$	[Nm]	Max. torque according to the manufacturer's instructions						
			No performance assessed	100	200				

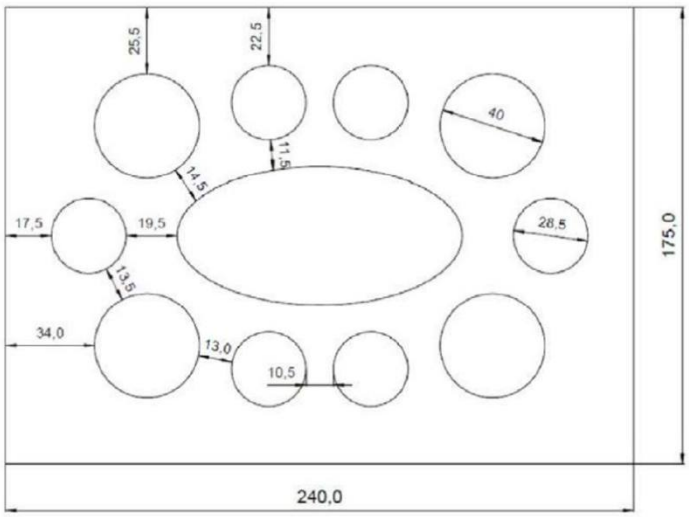
CLR plus and CLR plus ZF	
Performances Perforated calcium silicate brick KSL 3DF- material characteristics, installation parameters	**Annex C12**

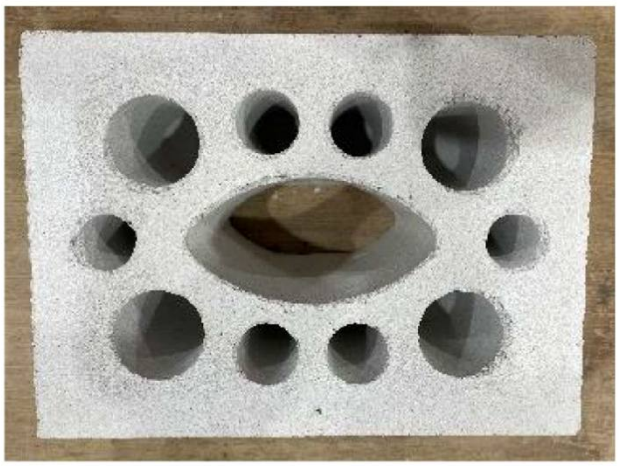
Table 24: Min. edge distance, spacing, group factors

CLR plus size			5	6		8		10	
Nominal embedment depth		h_{nom}	h_{nom1}	h_{nom1}	h_{nom2}	h_{nom1}	h_{nom2}	h_{nom1}	h_{nom2}
		[mm]	35	35	55	45	65	55	75
Min. edge distance	c_{min}	[mm]	58						
Min. spacing	$s_{min,II} = s_{min,\perp}$	[mm]	80						
Group factors	$\alpha_{g,N}$ ($s_{min\,II}$)	[-]	2,00	2,00	2,00	1,55	1,55	1,95	1,80
	$\alpha_{g,N}$ ($s_{min\,\perp}$)	[-]	2,00	2,00	2,00	1,55	1,55	1,45	1,70
	$\alpha_{g,V,II}$	[-]	2,00	2,00	2,00	2,00	2,00	2,00	2,00
	$\alpha_{g,V,\perp}$	[-]	2,00	1,80	1,80	1,80	1,80	1,30	1,30

Table 25: Reduction factors depending on the distance to joints

CLR plus size			5	6	8	10
Dinstance to joints	$c_{j\,\perp}$	[mm]	≥35			
	$c_{j\,II}$		≥58			
Reduction factor	$\alpha_{j,N}$	[-]	1 (full resistance)			
	$\alpha_{j,VII} = \alpha_{j,V\perp}$					
Distance to joints	$c_{j\,\perp}$	[mm]	<35			
	$c_{j\,II}$		<58			
Reduction factor	$\alpha_{j,N}$	[-]	Screw must not be used			





CLR plus and CLR plus ZF

Performance
Perforated calcium silicate brick KSL 3DF – min. edge distance and spacing, group factors and installation parameters close to the joints

Annex C13

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Table 26: Characteristic resistances

Use category (installation)			dry or wet						
CLR plus size			5	6		8		10	
Nominal embedment depth		h_{nom}	h_{nom1}	h_{nom1}	h_{nom2}	h_{nom1}	h_{nom2}	h_{nom1}	h_{nom2}
		[mm]	35	35	55	45	65	55	75
Compressive strength f_{mean}	[N/mm²]		≥ 17,0						
Characteristic resistance to tension load	N_{Rk}	[kN]	1,1	1,1	1,1	1,6	1,6	2,2	2,2
Characteristic resistance to shear load	$V_{Rk,II}$	[kN]	3,4						
	$V_{Rk,\perp}$	[kN]	1,6	1,6	1,6	1,6	1,6	2,2	2,2
Compressive strength f_{mean}	[N/mm²]		≥ 20,0						
Characteristic resistance to tension load	N_{Rk}	[kN]	1,3	1,3	1,3	1,9	1,9	2,5	2,5
Characteristic resistance to shear load	$V_{Rk,II}$	[kN]	3,8	3,8	3,8	3,8	3,8	3,9	3,9
	$V_{Rk,\perp}$	[kN]	1,8	1,8	1,8	1,8	1,8	2,5	2,5
Compressive strength f_{mean}	[N/mm²]		≥ 25,0						
Characteristic resistance to tension load	N_{Rk}	[kN]	1,5	1,5	1,5	2,2	2,2	3,0	3,0
Characteristic resistance to shear load	$V_{Rk,II}$	[kN]	4,5	4,5	4,5	4,5	4,5	4,6	4,6
	$V_{Rk,\perp}$	[kN]	2,1	2,1	2,1	2,1	2,1	2,9	2,9
Interaction	X	[-]	1,0						

CLR plus and CLR plus ZF

Performance
Perforated calcium silicate brick KSL 3DF – Characteristic resistances

Annex C14

Table 27: Displacements

Use category (Installation)			dry or wet						
CLR plus size			5	6		8		10	
Nominal embedment depth		h_{nom}	h_{nom1}	h_{nom1}	h_{nom2}	h_{nom1}	h_{nom2}	h_{nom1}	h_{nom2}
		[mm]	35	35	55	45	65	55	75
Tension load	F_N	[kN]	0,31	0,31	0,31	0,46	0,46	0,63	0,63
Displacement in tension direction	δ_{N0}	[mm]	0,01	0,01	0,01	0,01	0,01	0,01	0,01
	$\delta_{N\infty}$	[mm]	0,02	0,02	0,02	0,02	0,02	0,02	0,02
Shear load parallel to the edge	$F_{V,II}$	[kN]	0,97						
Displacement in shear direction parallel to the edge	$\delta_{V0,II}$	[mm]	0,80	0,80	0,80	0,80	0,80	1,42	1,42
	$\delta_{V\infty,II}$	[mm]	1,19	1,19	1,19	1,19	1,19	2,12	2,12
Shear load perpendicular to the edge	$F_{V,\perp}$	[kN]	0,46	0,46	0,46	0,46	0,46	0,63	0,63
Displacement in shear direction perpendicular to the edge	$\delta_{V0,\perp}$	[mm]	0,01	0,01	0,01	0,01	0,01	0,01	0,01
	$\delta_{V\infty,\perp}$	[mm]	0,02	0,02	0,02	0,02	0,02	0,02	0,02

Table 28: Performance under fire exposure for anchor groups

CLR plus size			5	6	
Nominal embedment depth		h_{nom}	h_{nom1}	h_{nom1}	h_{nom2}
		[mm]	35	35	55
Characteristic resistance to local brick failure of groups under fire exposure					
$N^g_{Rk,fi} = N^g_{Rk,b,fi} = N^g_{Rk,p,fi}$	[kN]	R30-R90	$0,09 \cdot N^g_{Rk,b}$	$0,09 \cdot N^g_{Rk,b}$	$0,15 \cdot N^g_{Rk,b}$
		R120	$0,08 \cdot N^g_{Rk,b}$	$0,08 \cdot N^g_{Rk,b}$	$0,12 \cdot N^g_{Rk,b}$
Min. edge distance and spacing	[mm]	$c_{min,fi} = c_{j,fi}$	$2 \times h_{nom}$ [1)]		
		$s_{min,fi}$	107		

[1)] At least the distances set out in Table 29 shall be observed

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Table 29: Fire exposure – Characteristic resistance

CLR plus size				5	6	
Nominal embedment depth			h_{nom}	h_{nom1}	h_{nom1}	h_{nom2}
			[mm]	35	35	55
Steel failure for tension and shear load						
Characteristic resistance	R30	$N_{Rk,s,fi30}$	[kN]	0,7	1,0	1,0
	R60	$N_{Rk,s,fi60}$	[kN]	0,6	0,8	0,8
	R90	$N_{Rk,s,fi90}$	[kN]	0,4	0,5	0,5
	R120	$N_{Rk,s,fi120}$	[kN]	0,3	0,4	0,4
	R30	$V_{Rk,s,fi30}$	[kN]	0,7	1,0	1,0
	R60	$V_{Rk,s,fi60}$	[kN]	0,6	0,8	0,8
	R90	$V_{Rk,s,fi90}$	[kN]	0,4	0,5	0,5
	R120	$V_{Rk,s,fi120}$	[kN]	0,3	0,4	0,4
	R30	$M^0_{Rk,s,fi30}$	[Nm]	0,5	0,8	0,8
	R60	$M^0_{Rk,s,fi60}$	[Nm]	0,4	0,6	0,6
	R90	$M^0_{Rk,s,fi90}$	[Nm]	0,2	0,4	0,4
	R120	$M^0_{Rk,s,fi120}$	[Nm]	0,2	0,3	0,3
Pull-out failure						
Characteristic resistance	R30	$N_{Rk,p,fi30}$	[kN]	0,7	0,6	0,6
	R60	$N_{Rk,p,fi60}$	[kN]	0,6	0,4	0,4
	R90	$N_{Rk,p,fi90}$	[kN]	0,4	0,3	0,3
	R120	$N_{Rk,p,fi120}$	[kN]	0,3	0,2	0,2
Breakout failure						
Characteristic resistance	R30	$N_{Rk,b,fi30}$	[kN]	0,7	0,6	0,6
	R60	$N_{Rk,b,fi60}$	[kN]	0,6	0,4	0,4
	R90	$N_{Rk,b,fi90}$	[kN]	0,4	0,3	0,3
	R120	$N_{Rk,b,fi120}$	[kN]	0,3	0,2	0,2
Edge and joint distance						
R30 - R120		$c_{min,fi} = c_{j,fi,II}$	[mm]	101		
		$c_{j,fi,\perp}$	[mm]	56		
Spacing						
R30 - R120		$s_{cr,fi}$	[mm]	$4 \times h_{nom}$		

CLR plus and CLR plus ZF

Performances
Perforated calcium silicate brick KSL 3DF – characteristic resistance under fire exposure

Annex C16

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Table 30: Material characteristic solid clay brick MZ

Solid clay brick MZ acc. to DIN EN 771-1:2015-11				
Nomenclature	Dimensions [mm]	Mean compressive strength [N/mm²]	Bulk density [kg/dm³]	Min. wall thickness h_{min} [mm]
MZ 20 - 2,0 - NF	L: ≥ 240 D: ≥ 115 H: ≥ 71	≥ 21,0	≥ 2,1	240

Table 31: Installation parameters solid clay brick MZ

Use category (installation)			dry or wet							
CLR plus size			5	6		8		10		
Nominal embedment depth		h_{nom}	h_{nom1}	h_{nom1}	h_{nom2}	h_{nom1}	h_{nom2}	h_{nom1}	h_{nom2}
		[mm]	35	35	55	45	65	55	75
Nominal drill hole diameter	d_0	[mm]	5	6		8		10	
Cutting diameter of drill bit	$d_{cut} \leq$	[mm]	5,40	6,40		8,45		10,45	
Drill hole depth	$h_0 \geq$	[mm]	55	55	75	65	85	75	95
Clearance hole diameter	$d_f \leq$	[mm]	7	8		12		14	
Torque for manual installation	max. T_{inst}	[Nm]	2	3		16		23	
Torque for rotary screwdriver installation	$T_{imp,max}$	[Nm]	4	9		14		No performance assessed	
Impact screw drvier	$T_{imp,max}$	[Nm]	Max. torque according to the manufacturer's instructions						
			No performance assessed					185	

CLR plus and CLR plus ZF	
Performances Solid clay brick MZ – material characteristic, installation parameters	**Annex C17**

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Table 32: Min. edge distance, spacing, group factors

CLR plus size			5	6		8		10	
Nominal embedment depth		h_{nom}	h_{nom1}	h_{nom1}	h_{nom2}	h_{nom1}	h_{nom2}	h_{nom1}	h_{nom2}
		[mm]	35	35	55	45	65	55	75
Min. edge distance	c_{min}	[mm]	80						
Min. spacing	$s_{min,II} = s_{min,\perp}$	[mm]	80						
Group factors	$\alpha_{g,N}$ ($s_{min\ II}$)	[-]	1,60	1,60	1,60	1,00	1,00	1,70	1,10
	$\alpha_{g,N}$ ($s_{min\ \perp}$)	[-]	1,75	1,75	1,75	1,15	1,15	1,45	1,40
	$\alpha_{g,V,II}$	[-]	1,45	1,45	1,45	1,45	1,45	2,00	1,05
	$\alpha_{g,V,\perp}$	[-]	1,20	1,20	1,20	1,20	1,20	1,50	1,15

Table 33: Reduction factors depending on the distance to joints

CLR plus size			5	6	8	10
Distance to joints	$c_{j\perp}$	[mm]	≥35			
	$c_{j\ II}$		≥80			
Reduction factor	$\alpha_{j,N}$	[-]	1 (full resistance)			
	$\alpha_{j,VII} = \alpha_{j,V\perp}$					
Distance to joints	$c_{j\perp}$	[mm]	<35			
	$c_{j\ II}$		<80			
Reduction factor	$\alpha_{j,N}$	[-]	Screw must not be used			

CLR plus and CLR plus ZF

Performances
Solid clay brick MZ – min. edge distance, spacing, group factors and installation parameters close to the joints

Annex C18

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Table 34: Characteristic resistances

Use category (installation)			dry or wet						
CLR plus size			5	6		8		10	
Nominal embedment depth		h_{nom}	h_{nom1}	h_{nom1}	h_{nom2}	h_{nom1}	h_{nom2}	h_{nom1}	h_{nom2}
		[mm]	35	35	55	45	65	55	75
Compressive strength f_{mean}	[N/mm²]		≥ 21,0						
Characteristic resistance to tension load	N_{Rk}	[kN]	1,6	1,6	1,6	2,3	2,3	3,1	3,2
Characteristic resistance to shear load	$V_{Rk,II}$	[kN]	2,5	2,5	2,5	2,5	2,5	2,6	8,1
	$V_{Rk,\perp}$	[kN]	2,1	2,1	2,1	2,1	2,1	2,1	2,7
Compressive strength f_{mean}	[N/mm²]		≥ 25,0						
Characteristic resistance to tension load	N_{Rk}	[kN]	1,7	1,7	1,7	2,5	2,5	3,4	3,5
Characteristic resistance to shear load	$V_{Rk,II}$	[kN]	2,7	2,7	2,7	2,7	2,7	2,8	8,9
	$V_{Rk,\perp}$	[kN]	2,3	2,3	2,3	2,3	2,3	2,3	3,0
Compressive strength f_{mean}	[N/mm²]		≥ 30,0						
Characteristic resistance to tension load	N_{Rk}	[kN]	1,9	1,9	1,9	2,8	2,8	3,7	3,8
Characteristic resistance to shear load	$V_{Rk,II}$	[kN]	2,9	2,9	2,9	2,9	2,9	3,1	9,7
	$V_{Rk,\perp}$	[kN]	2,5	2,5	2,5	2,5	2,5	2,5	3,2
Compressive strength f_{mean}	[N/mm²]		≥ 31,0						
Characteristic resistance to tension load	N_{Rk}	[kN]	1,9	1,9	1,9	2,8	2,8	3,8	3,9
Characteristic resistance to shear load	$V_{Rk,,II}$	[kN]	3,0	3,0	3,0	3,0	3,0	3,2	9,9
	$V_{Rk,,\perp}$	[kN]	2,5	2,5	2,5	2,5	2,5	2,6	3,3

CLR plus and CLR plus ZF

Performances
Solid clay brick MZ – characteristic resistances

Annex C19

Table 35: Displacements

Use category (installation)			dry or wet						
CLR plus size			5	6		8		10	
Nominal embedment depth		h_{nom}	h_{nom1}	h_{nom1}	h_{nom2}	h_{nom1}	h_{nom2}	h_{nom1}	h_{nom2}
		[mm]	35	35	55	45	65	55	75
Tension load	F_N	[kN]	0,46	0,46	0,46	0,66	0,66	0,89	0,91
Displacement in tension direction	δ_{N0}	[mm]	0,01	0,01	0,01	0,01	0,01	0,03	0,02
	$\delta_{N\infty}$	[mm]	0,02	0,02	0,02	0,02	0,02	0,05	0,05
Shear load parallel to the edge	$F_{V,II}$	[kN]	0,71	0,71	0,71	0,71	0,71	0,74	2,31
Displacement in shear direction parallel to the edge	$\delta_{V0,II}$	[mm]	1,08	1,08	1,08	1,08	1,08	0,04	2,24
	$\delta_{V\infty,II}$	[mm]	1,61	1,61	1,61	1,61	1,61	0,07	3,36
Shear load perpendicular to the edge	$F_{V,\perp}$	[kN]	0,60	0,60	0,60	0,60	0,60	0,60	0,77
Displacement in shear direction perpendicular to the edge	$\delta_{V0,\perp}$	[mm]	1,13	1,13	1,13	1,13	1,13	0,03	0,34
	$\delta_{V\infty,\perp}$	[mm]	1,69	1,69	1,69	1,69	1,69	0,04	0,51

Table 36: Performance under fire exposure for anchor groups

CLR plus size			5	6		8		10	
Nominal embedment depth		h_{nom}	h_{nom1}	h_{nom1}	h_{nom2}	h_{nom1}	h_{nom2}	h_{nom1}	h_{nom2}
		[mm]	35	35	55	45	65	55	75
Characteristic resistance to local brick failure of groups under fire exposure									
$N^g_{Rk,fi} = N^g_{Rk,b,fi} = N^g_{Rk,p,fi}$	[kN]	R30-R90	$0,09 \cdot N^g_{Rk,b}$	$0,09 \cdot N^g_{Rk,b}$	$0,15 \cdot N^g_{Rk,b}$	$0,12 \cdot N^g_{Rk,b}$	$0,18 \cdot N^g_{Rk,b}$	$0,15 \cdot N^g_{Rk,b}$	$0,24 \cdot N^g_{Rk,b}$
		R120	$0,08 \cdot N^g_{Rk,b}$	$0,08 \cdot N^g_{Rk,b}$	$0,12 \cdot N^g_{Rk,b}$	$0,10 \cdot N^g_{Rk,b}$	$0,15 \cdot N^g_{Rk,b}$	$0,12 \cdot N^g_{Rk,b}$	$0,19 \cdot N^g_{Rk,b}$
Min. edge distance and spacing	[mm]	$c_{min,fi} = c_{j,fi}$	$2 \times h_{nom}$ [1)]						
		$s_{min,fi}$	107						

[1)] At least the distances set out in Table 37 shall be observed

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Table 37: Fire exposure – Characteristic resistance

CLR plus size				5	6		8		10	
Nominal embedment depth			h_{nom}	h_{nom1}	h_{nom1}	h_{nom2}	h_{nom1}	h_{nom2}	h_{nom1}	h_{nom2}
			[mm]	35	35	55	45	65	55	75
Steel failure for tension and shear load										
Characteristic resistance	R30	$N_{Rk,s,fi30}$	[kN]	1,1	1,3	1,3	1,3	1,3	1,7	1,7
	R60	$N_{Rk,s,fi60}$	[kN]	0,8	1,0	1,0	1,0	1,0	1,6	1,6
	R90	$N_{Rk,s,fi90}$	[kN]	0,5	0,6	0,6	0,6	0,6	1,6	1,6
	R120	$N_{Rk,s,fi120}$	[kN]	0,3	0,5	0,5	0,5	0,5	1,5	1,5
	R30	$V_{Rk,s,fi30}$	[kN]	1,1	1,3	1,3	1,3	1,3	1,7	1,7
	R60	$V_{Rk,s,fi60}$	[kN]	0,8	1,0	1,0	1,0	1,0	1,6	1,6
	R90	$V_{Rk,s,fi90}$	[kN]	0,5	0,6	0,6	0,6	0,6	1,6	1,6
	R120	$V_{Rk,s,fi120}$	[kN]	0,3	0,5	0,5	0,5	0,5	1,5	1,5
	R30	$M^0_{Rk,s,fi30}$	[Nm]	0,8	1,1	1,1	1,5	1,5	2,5	2,5
	R60	$M^0_{Rk,s,fi60}$	[Nm]	0,5	0,8	0,8	1,1	1,1	2,4	2,4
	R90	$M^0_{Rk,s,fi90}$	[Nm]	0,3	0,5	0,5	0,8	0,8	2,3	2,3
	R120	$M^0_{Rk,s,fi120}$	[Nm]	0,2	0,4	0,4	0,6	0,6	2,2	2,2
Pull-out failure										
Characteristic resistance	R30	$N_{Rk,p,fi30}$	[kN]	1,1	1,3	1,3	1,3	1,3	1,7	1,7
	R60	$N_{Rk,p,fi60}$	[kN]	0,8	1,0	1,0	1,0	1,0	1,6	1,6
	R90	$N_{Rk,p,fi90}$	[kN]	0,5	0,6	0,6	0,6	0,6	1,6	1,6
	R120	$N_{Rk,p,fi120}$	[kN]	0,3	0,5	0,5	0,5	0,5	1,5	1,5
Breakout failure										
Characteristic resistance	R30	$N_{Rk,b,fi30}$	[kN]	1,1	1,3	1,3	1,3	1,3	1,7	1,7
	R60	$N_{Rk,b,fi60}$	[kN]	0,8	1,0	1,0	1,0	1,0	1,6	1,6
	R90	$N_{Rk,b,fi90}$	[kN]	0,5	0,6	0,6	0,6	0,6	1,6	1,6
	R120	$N_{Rk,b,fi120}$	[kN]	0,3	0,5	0,5	0,5	0,5	1,5	1,5
Edge and joint distance										
R30 - R120		$c_{min,fi} = c_{j,fi,II}$	[mm]	120						
		$c_{j,fi,\perp}$	[mm]	35						
Spacing										
R30 - R120		$s_{cr,fi}$	[mm]	$4 \times h_{nom}$						

CLR plus and CLR plus ZF

Performances
Solid clay brick MZ – characteristic resistance under fire exposure

Annex C21

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Table 38: Material characteristic solid light concrete brick VBL

Solid light concrete brick VBL acc. to DIN EN 771-3:2015-11				
Nomenclature	Dimensions [mm]	Mean compressive strength [N/mm²]	Bulk density [kg/dm³]	Min. wall thickness h_{min} [mm]
VBL 4 - 1,0 - 2DF	L: ≥ 240 D: ≥ 115 H: ≥ 113	≥ 4,0	≥ 1,5	240

Table 39: Installation parameters solid light concrete brick VBL

Use category (installation)			dry	
CLR plus size			8	10
Nominal embedment depth		h_{nom}	h_{nom}	h_{nom}
		[mm]	65	75
Nominal drill hole diameter	d_0	[mm]	8	10
Cutting diameter of drill bit	$d_{cut} \leq$	[mm]	8,45	10,45
Drill hole depth	$h_0 \geq$	[mm]	85	95
Clearance hole diameter	$d_f \leq$	[mm]	12	14
Torque for manual installation	max. T_{inst}	[Nm]	6	5
Torque for rotary screwdriver installation	$T_{imp,max}$	[Nm]	10	14

Table 40: Min. edge distance, spacing, group factors

CLR plus size			8	10
Nominal embedment depth		h_{nom}	h_{nom}	h_{nom}
		[mm]	65	75
Min. edge distance	c_{min}	[mm]	80	
Min. spacing	$s_{min,II} = s_{min,\perp}$	[mm]	80	
Group factors	$\alpha_{g,N}$ ($s_{min\,II}$)	[-]	1,45	1,45
	$\alpha_{g,N}$ ($s_{min\,\perp}$)	[-]	1,35	1,35
	$\alpha_{g,V,II}$	[-]	0,90	0,90
	$\alpha_{g,V,\perp}$	[-]	0,75	0,75

CLR plus and CLR plus ZF

Performances
Solid light concrete brick – material characteristics, installation parameters, min. edge distance and spacing, group factors

Annex C22

Table 41: Reduction factors depending on the distance to joints

CLR plus size			8	10
Distance to joints	$c_{j\perp}$	[mm]	≥35	
	$c_{j\,II}$		≥80	
Reduction factor	$\alpha_{j,\,N}$	[-]	1 (full resistance)	
	$\alpha_{j,\,VII} = \alpha_{j,\,V\perp}$			
Distance to joints	$c_{j\perp}$	[mm]	35	
	$c_{j\,II}$		80	
Reduction factor	$\alpha_{j,\,N}$	[-]	Screw must not be used	

Table 42: Characteristic resistances

Use category (installation)			dry	
CLR plus size			8	10
Nominal embedment depth		h_{nom}	h_{nom1}	h_{nom1}
		[mm]	65	75
Compressive strength f_{mean}	[N/mm²]		≥ 4,0	
Characteristic tension load	N_{Rk}	[kN]	0,6	1,2
Characteristic shear load	$V_{Rk,II}$	[kN]	4,0	5,1
	$V_{Rk,\perp}$	[kN]	2,3	3,3
Compressive strength f_{mean}	[N/mm²]		≥ 5,0	
Characteristic resistance to tension load	N_{Rk}	[kN]	0,7	1,4
Characteristic resistance to shear load	$V_{Rk,II}$	[kN]	4,4	5,7
	$V_{Rk,\perp}$	[kN]	2,6	3,7

CLR plus and CLR plus ZF

Performances
Solid light concrete brick – characteristic resistances and installation parameters close to the joints

Annex C23

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Table 43: Displacements

Use category (installation)			dry	
CLR plus size			8	10
Nominal embedment depth		h_{nom}	h_{nom}	h_{nom}
		[mm]	65	75
Tension load	F_N	[kN]	0,17	0,34
Displacement in tension direction	δ_{N0}	[mm]	0,01	0,01
	$\delta_{N\infty}$	[mm]	0,02	0,02
Shear load parallel to the edge	$F_{V,II}$	[kN]	1,14	1,46
Displacement in shear direction parallel to the edge	$\delta_{V0,II}$	[mm]	1,94	2,11
	$\delta_{V\infty,II}$	[mm]	2,92	3,16
Shear load perpendicular to the edge	$F_{V,\perp}$	[kN]	0,66	0,94
Displacement in shear direction perpendicular to the edge	$\delta_{V0,\perp}$	[mm]	0,36	1,92
	$\delta_{V\infty,\perp}$	[mm]	0,54	2,89

CLR plus and CLR plus ZF

Performances
Solid light concrete brick – displacements

Annex C24