Deutsches Institut für Bautechnik

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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-23/0196 of 2 August 2023

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	WÜRTH concrete screw W-BS/S
Product family to which the construction product belongs	Screw anchor for use in masonry
Manufacturer	Adolf Würth GmbH & Co. KG Reinhold Würth Straße 12-17 74650 Künzelsau DEUTSCHLAND
Manufacturing plant	Werk 9
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	330460-00-0604, Edition 08/2022

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Specific Part

1 Technical description of the product

The WÜRTH concrete screw W-BS/S 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.

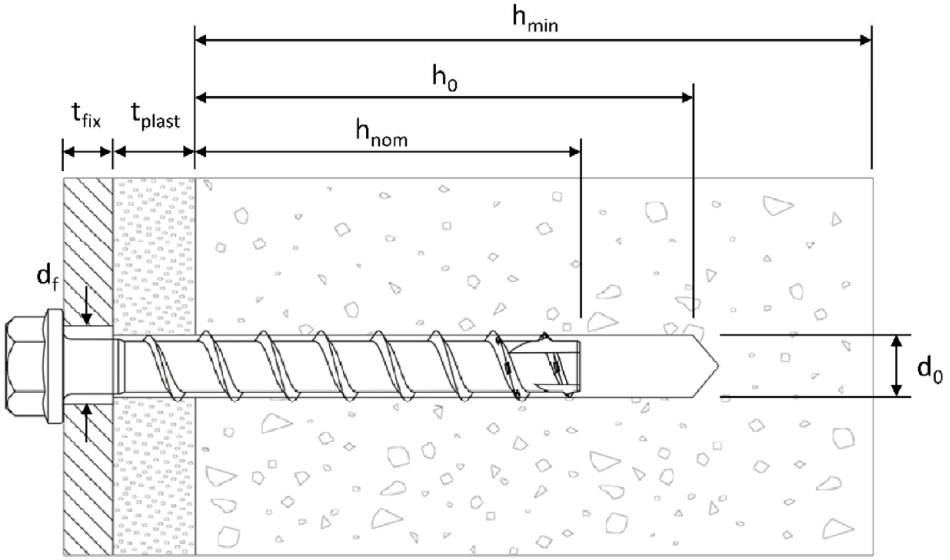
Issued in Berlin on 2 August 2023 by Deutsches Institut für Bautechnik

Dipl.-Ing. Beatrix Wittstock
Head of Section

beglaubigt:
Pascal Stiller

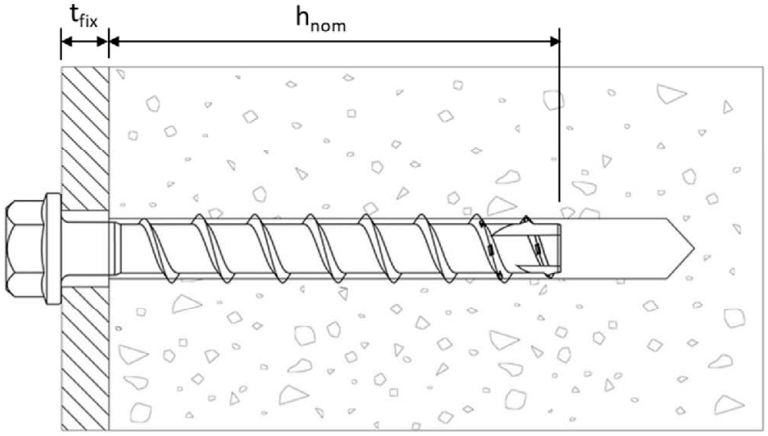
Deutsches Institut für Bautechnik DIBt

Product in installed condition

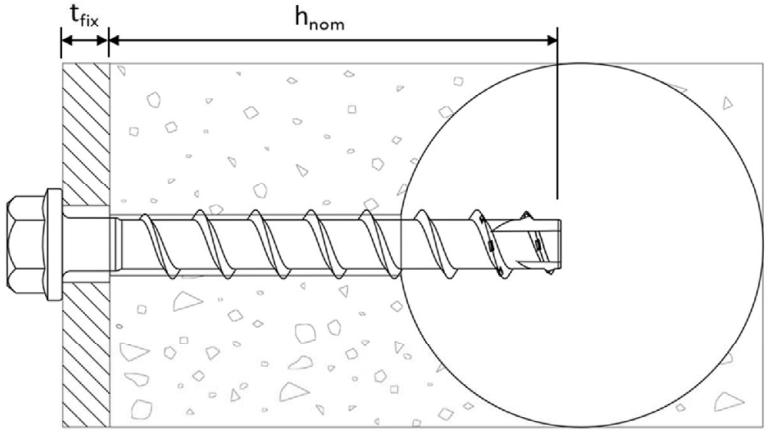


WÜRTH concrete screw W-BS/S

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



WÜRTH concrete screw W-BS/S
in solid brick



WÜRTH concrete screw W-BS/S
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

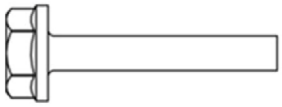
WÜRTH concrete screw W-BS/S

Product description
Product in installed condition

Annex A1

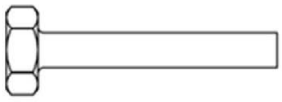
Deutsches Institut für Bautechnik DIBt


Configuration e.g. with threaded stud and hexagon drive e.g. W-BS 8x105 Typ ST M10 WS7



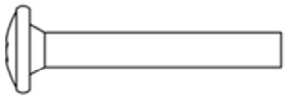

Configuration with washer and hexagon head e.g. W-BS 8x80 Typ S WS13


Configuration with washer, hexagon head and TX drive e.g. W-BS 8x80 Typ S WS13 and TX 40

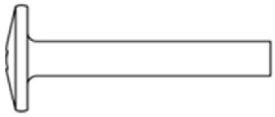



Configuration with hexagon head e.g. W-BS 8x80 Typ S WS13

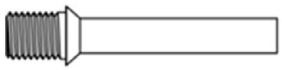

Configuration with countersunk head and TX drive e.g. W-BS 8x80 Typ SK TX 40



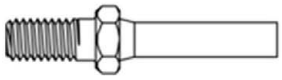

Configuration with pan head and TX drive e.g. W-BS 8x80 Typ P TX 40



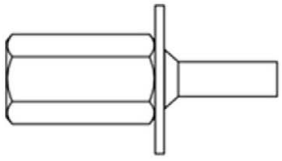

Configuration with large pan head and TX drive e.g. W-BS 8x80 Typ P TX 40




Configuration with countersunk head and threaded stud e.g. W-BS 6x55 Typ ST-6 M8 TX30




Configuration with hexagon drive and threaded stud e.g. W-BS 6x55 Typ ST-6 M8 SW10




Configuration with internal thread and hexagon drive e.g. W-BS 6x55 TYP I M8/10 WS13

WÜRTH concrete screw W-BS/S

Product description
Screw types

Annex A2

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Table 1: Material

Part	Product name	Material
All types	W-BS/S	- Steel EN 10263-4:2017 galvanized acc. to EN ISO 4042:2018 - Zinc flake coating according to EN ISO 10683:2018 (≥5µm) - Zinc flake coating according to EN ISO 10683:2018 special coating Special coating TCC (≥20µm)

Part	Product name	Nominal characteristic steel		Elongation
		Yield strength f_{yk} [N/mm²]	Ultimate strength f_{uk} [N/mm²]	A_5 [%]
All types	W-BS/S	560	700	≤ 8

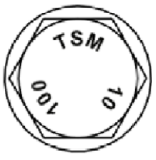
Table 2: Dimensions

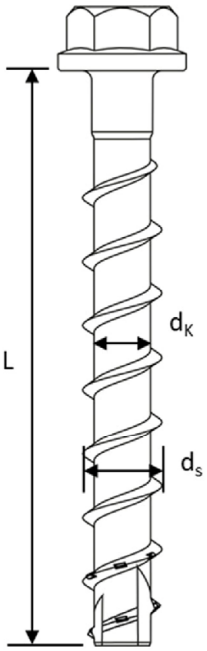
Concrete screw size			5	6		8		10	
Nominal embedment depth		h_{nom}	h_{nom1}	h_{nom1}	h_{nom2}	h_{nom1}	h_{nom2}	h_{nom1}	h_{nom2}
		[mm]	35	35	55	45	65	55	75
Screw length	≤ L	[mm]	500						
Core diameter	d_K	[mm]	4,0	5,1		7,1		9,1	
Thread outer diameter	d_s	[mm]	6,5	7,5		10,6		12,6	

Marking:

W-BS/S

Screw type: W-BS or TSM
Screw size: 6
Screw length: 60





WÜRTH concrete screw W-BS/S

Product description
Material, dimensions and marking

Annex A3

Deutsches Institut für Bautechnik DIBt

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.

WÜRTH concrete screw W-BS/S	
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.

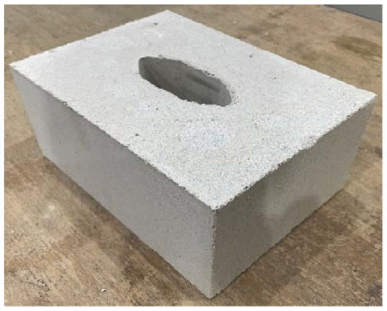
WÜRTH concrete screw W-BS/S	
Intended use Specification continuation	**Annex B2**

Deutsches Institut für Bautechnik DIBt

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

WÜRTH concrete screw W-BS/S

Intended use
Solid and perforated bricks, dimensions and properties

Annex B3

Deutsches Institut für Bautechnik DIBt

Table 4: General installation parameters

W-BS screw 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	

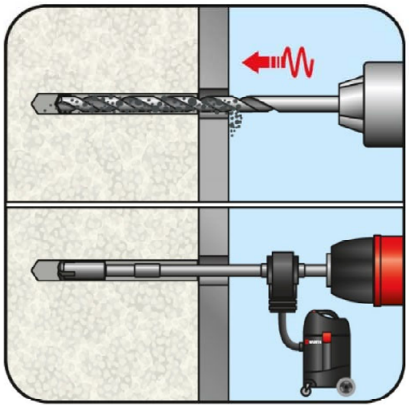
WÜRTH concrete screw W-BS/S

Intended use
General installation parameters

Annex B4

Deutsches Institut für Bautechnik DIBt

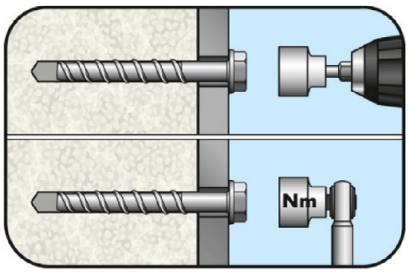
Installation instruction



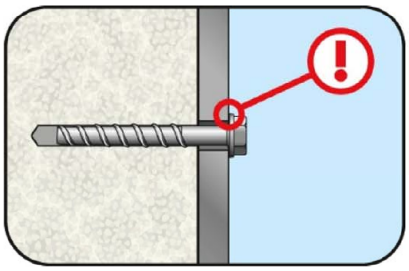
Drill hole in hammer mode or rotary mode. Joint distances, spacing and edge distances must be taken into account.

Optional:
Remove dust by suction or blow it out.
Alternatively, ventilate the drill hole three times. Therefore, pull the rotating drill out of the drill hole. Start a the bottom of the drill hole.

Alternative: Use a suction drill bit



Screw in with a tangential impact screwdriver, drill driver or manually with a ratchet or screwdriver.
For further details on screwing in, please refer to the brick-type-related Annexes C2 to C24.
The maximum torque $T_{imp,max}$ or T_{inst} shall be considered.

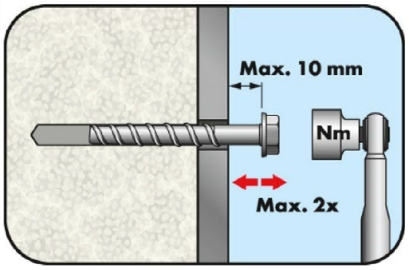


The screw head must be in contact with the fixture and must not be damaged. It must not be possible to continue turning the screw easily. The maximum torque T_{inst} must not be exceeded during a check.

WÜRTH concrete screw W-BS/S	
Intended use Installation Instructions	**Annex B5**

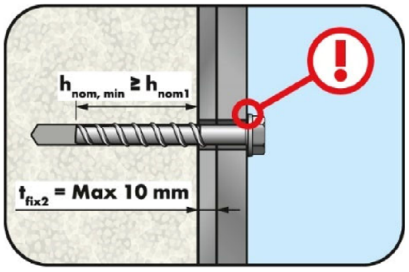
Deutsches Institut für Bautechnik DIBt

Installation Instruction - Adjustment



Screw out a maximum of 10 mm, align the fixture, support it and screw it tight again. The maximum torque T_{inst} must be considered.

Optional:
Screw out a maximum of 10 mm a second time, align the fixture, support it and screw it tight again. The maximum torque T_{inst} must be considered.



After adjustment the screw head must be in contact with the fixture and must not be damaged. It must not be possible to continue turning the screw easily. The maximum torque T_{inst} must not be exceeded during the test.

All in all, the fixture may not be supported more than 10 mm.

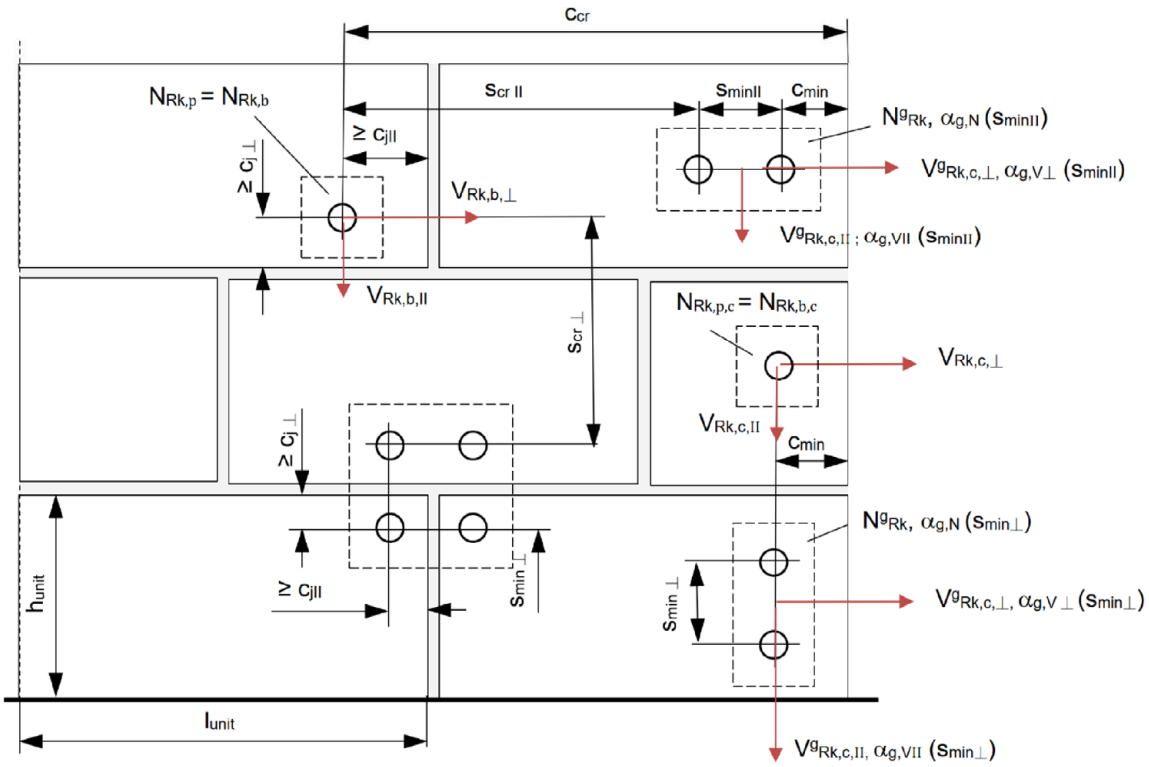
The required embedment depth h_{nom} must at least be adhered to. Consider the maximum torque $T_{imp,max}$ or. T_{inst} also during adjustment.

The maximum torque T_{inst} must not be exceeded during a check.

WÜRTH concrete screw W-BS/S	
Intended use Installation instruction – adjustment	**Annex B6**

Deutsches Institut für Bautechnik DIBt

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
$s_{min\,II}$	= 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
$\alpha_{g,N}(s_{min\,II})$	= 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 ($\alpha_{g,V\parallel} = \alpha_{g,V\parallel}(s_{min\,II}) = \alpha_{g,V\parallel}(s_{min\perp})$)
$\alpha_{g,V\perp}$	= group factor under shear load perpendicular to the edge ($\alpha_{g,V\perp} = \alpha_{g,V\perp}(s_{min\,II}) = \alpha_{g,V\perp}(s_{min\perp})$)

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

Für $s \geq s_{cr}$: $\alpha_{g,N}(s_{min\,II}) = \alpha_{g,N}(s_{min\perp}) = \alpha_{g,V\parallel} = \alpha_{g,V\perp} = 2$
Für $s_{min} \leq s \leq s_{cr}$: $\alpha_{g,N}(s_{min\,II})$; $\alpha_{g,N}(s_{min\perp})$; $\alpha_{g,V\parallel}$; $\alpha_{g,V\perp}$ according to installation parameters of brick in Annex C
$N^g_{Rk}(s_{min\,II}) = \alpha_{g,N}(s_{min\,II}) \times N_{Rk}$ (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)
$N^g_{Rk} = \alpha_{g,N}(s_{min\,II}) \times \alpha_{g,N}(s_{min\perp}) \times N_{Rk}$ (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)

WÜRTH concrete screw W-BS/S

Intended use
Possible installation position

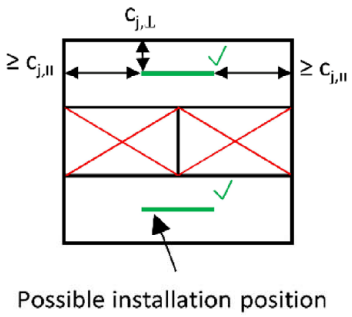
Annex B7

Deutsches Institut für Bautechnik DIBt

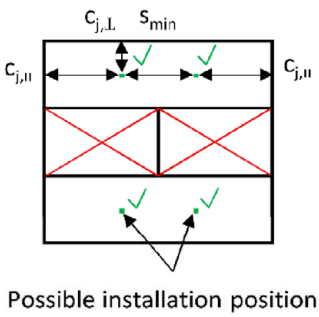
Installations parameter for installation in the reveal site

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

Single anchor

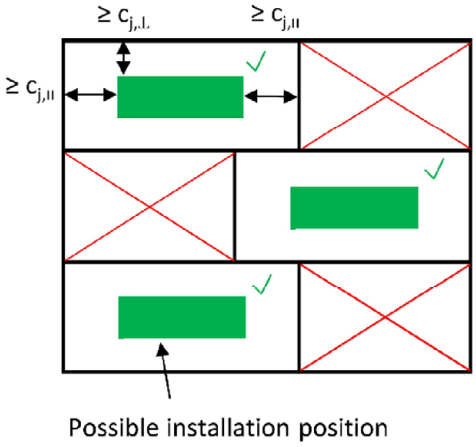


Double anchor group

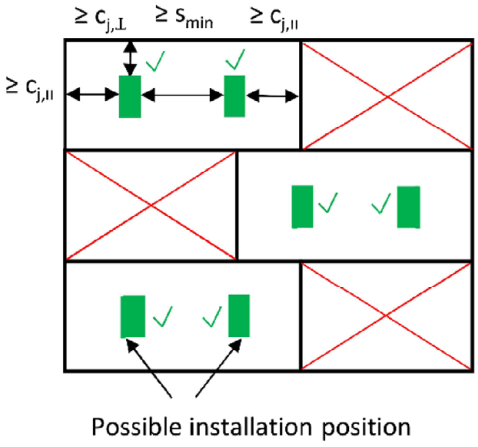


Positioning in reveal in brick type KSL 3DF

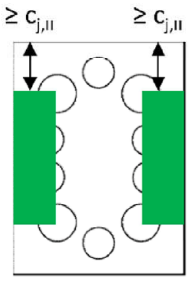
Single anchor



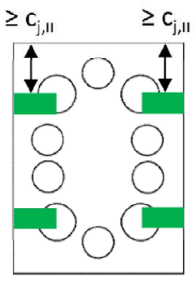
Double anchor group



Top view



Top view



WÜRTH concrete screw W-BS/S

Intended use
Possible installation in reveal

Annex B8

Deutsches Institut für Bautechnik DIBt

Table 5: Characteristic resistance to steel failure

W-BS screw 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

WÜRTH concrete screw W-BS/S

Performances
Characteristic resistance to steel failure

Annex C1

Deutsches Institut für Bautechnik DIBt

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							
W-BS screw 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	
Max. torque for manual installation	$T_{inst} \leq$	[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

W-BS screw 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						

WÜRTH concrete screw W-BS/S

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

Annex C2

Deutsches Institut für Bautechnik DIBt

Table 9: Reduction factors depending on the distance to joints

W-BS screw 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			

WÜRTH concrete screw W-BS/S

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						
W-BS screw 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						

WÜRTH concrete screw W-BS/S

Performance
Solid calcium silicate brick KS – characteristic resistances

Annex C4

Deutsches Institut für Bautechnik DIBt

Table 11: Displacements

Use category (installation)			dry or wet						
W-BS screw 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

W-BS screw 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					
$N^g_{Rk,fi}$	[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 13 shall be observed

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Table 13: Fire exposure – Characteristic resistance

W-BS screw 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]	1,10	1,50	1,50
	R60	$N_{Rk,s,fi60}$	[kN]	0,80	1,10	1,10
	R90	$N_{Rk,s,fi90}$	[kN]	0,50	0,60	0,60
	R120	$N_{Rk,s,fi120}$	[kN]	0,30	0,40	0,40
	R30	$V_{Rk,s,fi30}$	[kN]	1,10	1,50	1,50
	R60	$V_{Rk,s,fi60}$	[kN]	0,80	1,10	1,10
	R90	$V_{Rk,s,fi90}$	[kN]	0,50	0,60	0,60
	R120	$V_{Rk,s,fi120}$	[kN]	0,30	0,40	0,40
	R30	$M^0_{Rk,s,fi30}$	[Nm]	0,80	1,20	1,20
	R60	$M^0_{Rk,s,fi60}$	[Nm]	0,50	0,90	0,90
	R90	$M^0_{Rk,s,fi90}$	[Nm]	0,30	0,50	0,50
	R120	$M^0_{Rk,s,fi120}$	[Nm]	0,20	0,30	0,30
Pull-out failure						
Characteristic resistance	R30	$N_{Rk,p,fi30}$	[kN]	1,10	0,40	0,72
	R60	$N_{Rk,p,fi60}$	[kN]	0,80	0,40	0,72
	R90	$N_{Rk,p,fi90}$	[kN]	0,50	0,40	0,72
	R120	$N_{Rk,p,fi120}$	[kN]	0,30	0,32	0,57
Breakout failure						
Characteristic resistance	R30	$N_{Rk,b,fi30}$	[kN]	1,10	0,28	0,79
	R60	$N_{Rk,b,fi60}$	[kN]	0,80	0,28	0,79
	R90	$N_{Rk,b,fi90}$	[kN]	0,50	0,28	0,79
	R120	$N_{Rk,b,fi120}$	[kN]	0,30	0,23	0,63
Edge and joint distance						
R30 - R120		$c_{min,fi} = c_{j,fi,II}$	[mm]	120	120	120
		$c_{j,fi,\perp}$	[mm]	35	35	35
Spacing						
R30 - R120		$s_{cr,fi}$	[mm]	4 x h_{nom}		

WÜRTH concrete screw W-BS/S

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

Annex C6

Deutsches Institut für Bautechnik DIBt

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							
W-BS screw 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	
Max. torque for manual installation	$T_{inst} \leq$	[Nm]	6	10		25		45	
Max. torque for drill driver installation	$T_{inst} \leq$	[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			

WÜRTH concrete screw W-BS/S

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

Annex C7

Deutsches Institut für Bautechnik DIBt

Table 16: Min edge distance, spacing, group factors

W-BS screw 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

W-BS screw 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			
	$c_{j\,II}$		<80			
Reduction factor	$\alpha_{j,N}$	[-]	Screw must not be used			

WÜRTH concrete screw W-BS/S

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						
W-BS screw 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

WÜRTH concrete screw W-BS/S

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

Annex C9

Deutsches Institut für Bautechnik DIBt

Table 19: Displacements

Use category (installation)			dry or wet						
W-BS screw 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

W-BS screw 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					
$N^g_{Rk,fi}$	[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 21 shall be observed

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Table 21: Fire exposure – Characteristic resistance

W-BS screw 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]	1,10	1,50	1,50
	R60	$N_{Rk,s,fi60}$	[kN]	0,80	1,10	1,10
	R90	$N_{Rk,s,fi90}$	[kN]	0,50	0,60	0,60
	R120	$N_{Rk,s,fi120}$	[kN]	0,30	0,40	0,40
	R30	$V_{Rk,s,fi30}$	[kN]	1,10	1,50	1,50
	R60	$V_{Rk,s,fi60}$	[kN]	0,80	1,10	1,10
	R90	$V_{Rk,s,fi90}$	[kN]	0,50	0,60	0,60
	R120	$V_{Rk,s,fi120}$	[kN]	0,30	0,40	0,40
	R30	$M^0_{Rk,s,fi30}$	[Nm]	0,80	1,20	1,20
	R60	$M^0_{Rk,s,fi60}$	[Nm]	0,50	0,90	0,90
	R90	$M^0_{Rk,s,fi90}$	[Nm]	0,30	0,50	0,50
	R120	$M^0_{Rk,s,fi120}$	[Nm]	0,20	0,30	0,30
Pull-out failure						
Characteristic resistance	R30	$N_{Rk,p,fi30}$	[kN]	1,10	0,40	0,72
	R60	$N_{Rk,p,fi60}$	[kN]	0,80	0,40	0,72
	R90	$N_{Rk,p,fi90}$	[kN]	0,50	0,40	0,72
	R120	$N_{Rk,p,fi120}$	[kN]	0,30	0,32	0,57
Breakout failure						
Characteristic resistance	R30	$N_{Rk,b,fi30}$	[kN]	1,10	0,28	0,79
	R60	$N_{Rk,b,fi60}$	[kN]	0,80	0,28	0,79
	R90	$N_{Rk,b,fi90}$	[kN]	0,50	0,28	0,79
	R120	$N_{Rk,b,fi120}$	[kN]	0,30	0,23	0,63
Edge and joint distance						
R30 - R120		$c_{min,fi} = c_{j,fi,II}$	[mm]	120	120	120
		$c_{j,fi,\perp}$	[mm]	35	35	35
Spacing						
R30 - R120		$s_{cr,fi}$	[mm]	$4 \times h_{nom}$		

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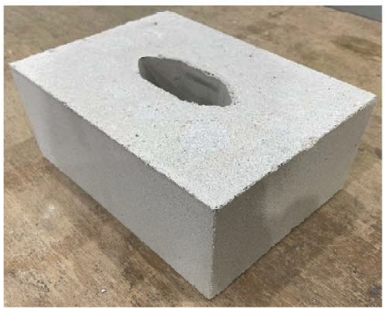
Table 22: Material characteristics perforated calcium silicate brick KSL 3DF



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							
W-BS screw 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	
Max. torque for manual installation	$T_{inst} \leq$	[Nm]	3	4		9		9	
Max. torque for drill driver installation	$T_{inst} \leq$	[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			

WÜRTH concrete screw W-BS/S

Performances
Perforated calcium silicate brick KSL 3DF- material characteristics, installation parameters

Annex C12

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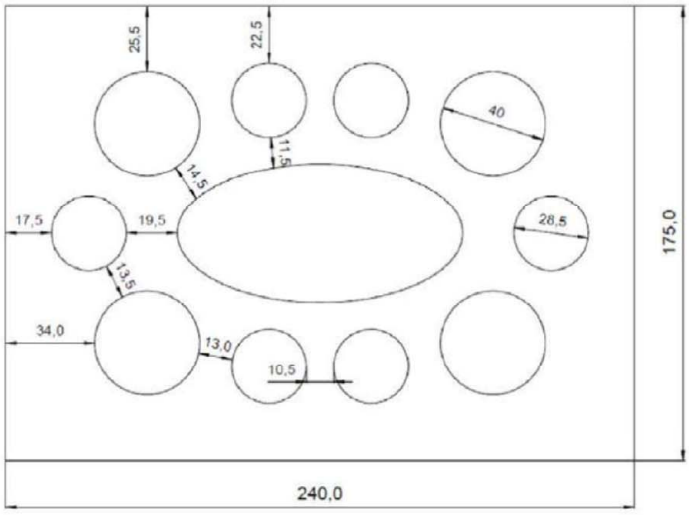
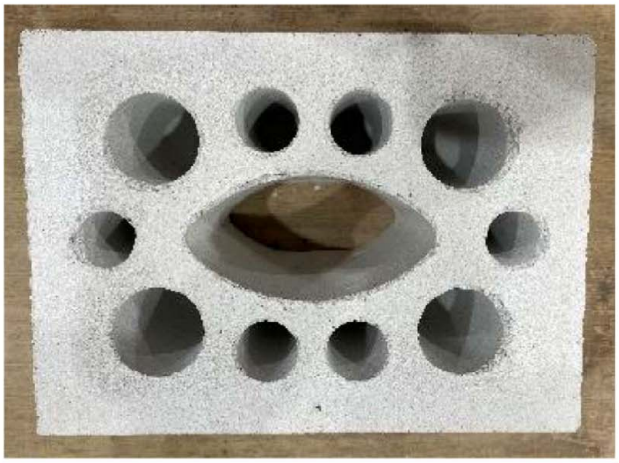
Table 24: Min. edge distance, spacing, group factors

W-BS screw 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

W-BS screw 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			





WÜRTH concrete screw W-BS/S

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

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Table 26: Characteristic resistances

Use category (installation)			dry or wet						
W-BS screw 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						

WÜRTH concrete screw W-BS/S

Performance
Perforated calcium silicate brick KSL 3DF – Characteristic resistances

Annex C14

Deutsches Institut für Bautechnik DIBt

Table 27: Displacements

Use category (Installation)			dry or wet						
W-BS screw 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

W-BS screw 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					
$N^g_{Rk,fi}$	[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

W-BS screw 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]	0,70	1,00	1,00
	R60	$N_{Rk,s,fi60}$	[kN]	0,60	0,80	0,80
	R90	$N_{Rk,s,fi90}$	[kN]	0,40	0,50	0,50
	R120	$N_{Rk,s,fi120}$	[kN]	0,30	0,40	0,40
	R30	$V_{Rk,s,fi30}$	[kN]	0,70	1,00	1,00
	R60	$V_{Rk,s,fi60}$	[kN]	0,60	0,80	0,80
	R90	$V_{Rk,s,fi90}$	[kN]	0,40	0,50	0,50
	R120	$V_{Rk,s,fi120}$	[kN]	0,30	0,40	0,40
	R30	$M^0_{Rk,s,fi30}$	[Nm]	0,50	0,80	0,80
	R60	$M^0_{Rk,s,fi60}$	[Nm]	0,40	0,60	0,60
	R90	$M^0_{Rk,s,fi90}$	[Nm]	0,20	0,40	0,40
	R120	$M^0_{Rk,s,fi120}$	[Nm]	0,20	0,30	0,30
Pull-out failure						
Characteristic resistance	R30	$N_{Rk,p,fi30}$	[kN]	0,70	0,19	0,19
	R60	$N_{Rk,p,fi60}$	[kN]	0,60	0,19	0,19
	R90	$N_{Rk,p,fi90}$	[kN]	0,40	0,19	0,19
	R120	$N_{Rk,p,fi120}$	[kN]	0,30	0,15	0,15
Breakout failure						
Characteristic resistance	R30	$N_{Rk,b,fi30}$	[kN]	0,70	0,13	0,21
	R60	$N_{Rk,b,fi60}$	[kN]	0,60	0,13	0,21
	R90	$N_{Rk,b,fi90}$	[kN]	0,40	0,13	0,21
	R120	$N_{Rk,b,fi120}$	[kN]	0,30	0,11	0,17
Edge and joint distance						
R30 - R120		$c_{min,fi} = c_{j,fi,II}$	[mm]	101	101	101
		$c_{j,fi,\perp}$	[mm]	56	56	56
Spacing						
R30 - R120		$s_{cr,fi}$	[mm]	$4 \times h_{nom}$		

WÜRTH concrete screw W-BS/S

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

Annex C16

Deutsches Institut für Bautechnik DIBt

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							
W-BS screw 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	
Max. torque for manual installation	$T_{inst} \leq$	[Nm]	2	3		16		23	
Max. torque for drill driver installation	$T_{inst} \leq$	[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	

WÜRTH concrete screw W-BS/S

Performances
Solid clay brick MZ – material characteristic, installation parameters

Annex C17

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

W-BS screw 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

W-BS screw 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			

WÜRTH concrete screw W-BS/S

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

Annex C18

Deutsches Institut für Bautechnik DIBt

Table 34: Characteristic resistances

Use category (installation)			dry or wet						
W-BS screw 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

WÜRTH concrete screw W-BS/S

Performances
Solid clay brick MZ – characteristic resistances

Annex C19

Deutsches Institut für Bautechnik DIBt

Table 35: Displacements

Use category (installation)			dry or wet						
W-BS screw 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

W-BS screw size			5	6	
Nominal embedment depth		h_{nom}	h_{nom1}	h_{nom1}	h_{nom2}
		[mm]	35	35	55
Characteristic resistance local brick failure of groups under fire exposure					
$N^g_{Rk,fi}$	[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 37 shall be observed

WÜRTH concrete screw W-BS/S

Performances
Solid clay brick MZ – displacements and performance under fire exposure for anchor groups

Annex C20

Deutsches Institut für Bautechnik DIBt

Table 37: Fire exposure – Characteristic resistance

W-BS screw 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]	1,10	1,50	1,50
	R60	$N_{Rk,s,fi60}$	[kN]	0,80	1,10	1,10
	R90	$N_{Rk,s,fi90}$	[kN]	0,50	0,60	0,60
	R120	$N_{Rk,s,fi120}$	[kN]	0,30	0,40	0,40
	R30	$V_{Rk,s,fi30}$	[kN]	1,10	1,50	1,50
	R60	$V_{Rk,s,fi60}$	[kN]	0,80	1,10	1,10
	R90	$V_{Rk,s,fi90}$	[kN]	0,50	0,60	0,60
	R120	$V_{Rk,s,fi120}$	[kN]	0,30	0,40	0,40
	R30	$M^0_{Rk,s,fi30}$	[Nm]	0,80	1,20	1,20
	R60	$M^0_{Rk,s,fi60}$	[Nm]	0,50	0,90	0,90
	R90	$M^0_{Rk,s,fi90}$	[Nm]	0,30	0,50	0,50
	R120	$M^0_{Rk,s,fi120}$	[Nm]	0,20	0,30	0,30
Pull-out failure						
Characteristic resistance	R30	$N_{Rk,p,fi30}$	[kN]	1,10	0,28	0,28
	R60	$N_{Rk,p,fi60}$	[kN]	0,80	0,28	0,28
	R90	$N_{Rk,p,fi90}$	[kN]	0,50	0,28	0,28
	R120	$N_{Rk,p,fi120}$	[kN]	0,30	0,22	0,22
Breakout failure						
Characteristic resistance	R30	$N_{Rk,b,fi30}$	[kN]	1,10	0,20	0,31
	R60	$N_{Rk,b,fi60}$	[kN]	0,80	0,20	0,31
	R90	$N_{Rk,b,fi90}$	[kN]	0,50	0,20	0,31
	R120	$N_{Rk,b,fi120}$	[kN]	0,30	0,16	0,25
Edge and joint distance						
R30 - R120		$c_{min,fi} = c_{j,fi,II}$	[mm]	120	120	120
		$c_{j,fi,\perp}$	[mm]	35	35	35
Spacing						
R30 - R120		$s_{cr,fi}$	[mm]	$4 \times h_{nom}$		

WÜRTH concrete screw W-BS/S

Performances
Solid clay brick MZ – characteristic resistance under fire exposure

Annex C21

Deutsches Institut für Bautechnik DIBt

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	
W-BS screw 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
Max. torque for manual installation	$T_{inst} \leq$	[Nm]	6	5
Max. torque for drill driver installation	$T_{inst} \leq$	[Nm]	10	14

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

W-BS screw 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

WÜRTH concrete screw W-BS/S

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

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Table 41: Reduction factors depending on the distance to joints

W-BS screw size			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	

Table 42: Characteristic resistances

Use category (installation)			dry	
W-BS screw 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	$V_{Rk,\parallel}$	[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	$V_{Rk,\parallel}$	[kN]	4,4	5,7
	$V_{Rk,\perp}$	[kN]	2,6	3,7

WÜRTH concrete screw W-BS/S

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

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Table 43: Displacements

Use category (installation)			dry	
W-BS screw 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

WÜRTH concrete screw W-BS/S

Performances
Solid light concrete brick – displacements

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