

Approval body for construction products
and types of construction

Bautechnisches Prüfamt

An institution established by the Federal and
Laender Governments



European Technical Assessment

ETA-16/0516
of 1 October 2019

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

Walraven concrete screw WCS1

Product family
to which the construction product belongs

Fasteners for use in concrete for redundant non-structural
systems

Manufacturer

J. van Walraven Holding B.V.
Industrieweg 5
3641 RK Mijdrecht
NIEDERLANDE

Manufacturing plant

Walraven Factory A4

This European Technical Assessment
contains

16 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 330747-00-0601

This version replaces

ETA-16/0516 issued on 16 August 2016

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Specific Part

1 Technical description of the product

The Walraven concrete screw WCS1 of sizes 5 and 6 mm is an anchor made of galvanised steel respectively steel with zinc flake coating and of stainless 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 characterised 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 EAD

The performances given in Section 3 are only valid if the anchor is used in compliance with the specifications and conditions given in Annex B.

The verifications and assessment methods on which this European Technical Assessment is based lead to the assumption of a working life of the anchor of at least 50 years. The indications given on the working life cannot be interpreted as a guarantee given by the producer, but are to be regarded only as a means for choosing the right products in relation to the expected economically reasonable working life of the works.

3 Performance of the product and references to the methods used for its assessment

3.1 Safety in case of fire (BWR 2)

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

3.2 Safety in use (BWR 4)

Essential characteristic	Performance
Characteristic resistance to tension load (static and quasi-static loading)	See Annex C 1 and C 2
Characteristic resistance to shear load (static and quasi-static loading)	See Annex C 1 and C 2

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

In accordance with European Assessment Document EAD No. 330747-00-0601, the applicable European legal act is: [97/161/EC].

The system to be applied is: 2+

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 1 October 2019 by Deutsches Institut für Bautechnik

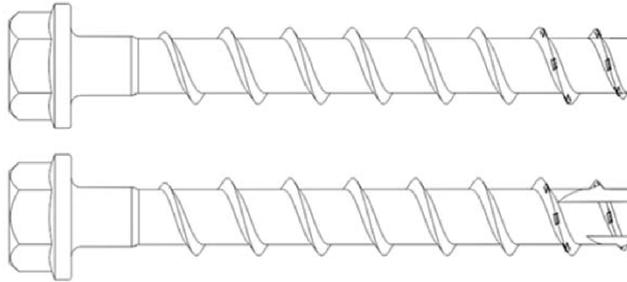
BD Dipl.-Ing. Andreas Kummerow
Head of Department

beglaubigt:
Tempel

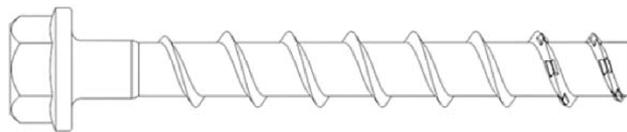
Product in installed condition

Walraven concrete screw WCS1

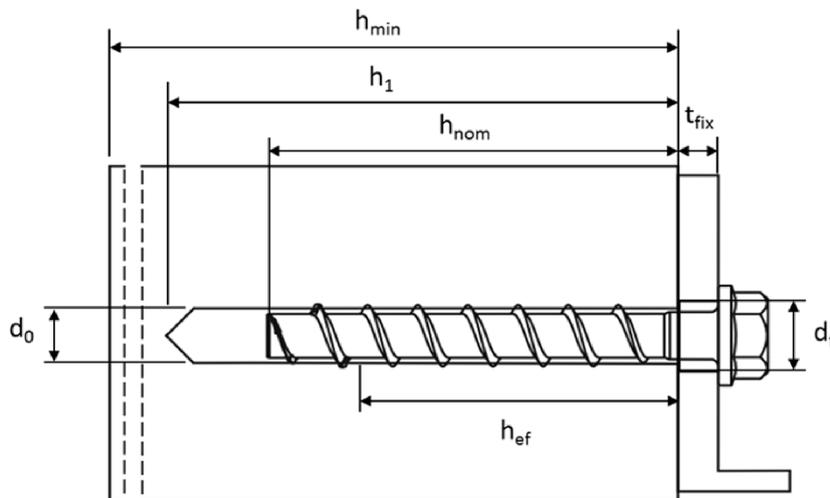
- Galvanized carbon steel
- Zinc flakes coated carbon steel



- Stainless steel A4
- Stainless steel HCR



e.g. Walraven concrete screw WCS1H with hexagon head and fixture



d_0 = nominal drill hole diameter
 t_{fix} = thickness of fixture
 d_f = clearance hole diameter

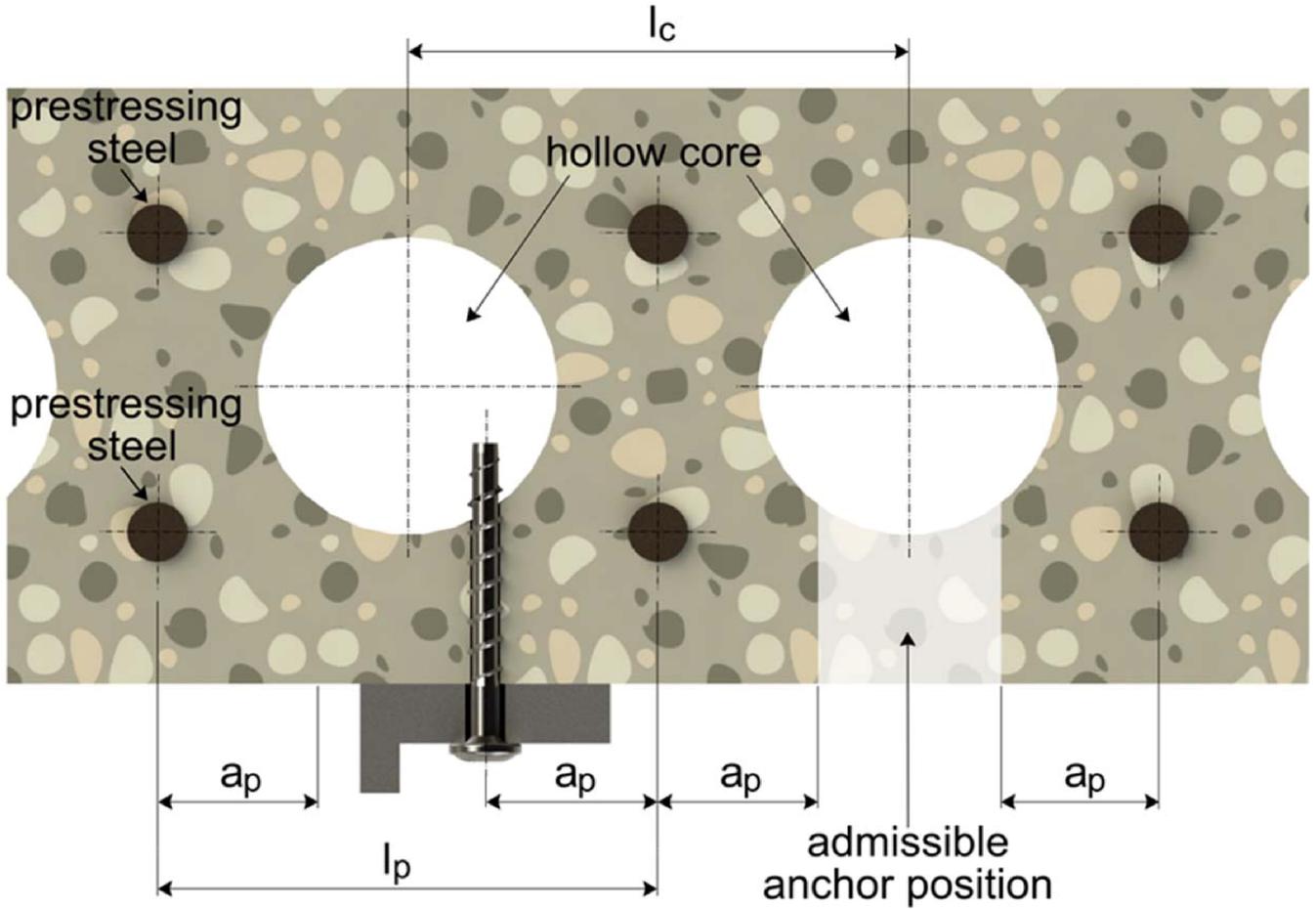
h_{min} = minimum thickness of member
 h_{nom} = nominal embedment depth
 h_1 = drill hole depth
 h_{ef} = effective embedment depth

Walraven concrete screw WCS1

Product description
Product in installed condition

Annex A1

Installed condition in precast prestressed hollow core slabs



Important ratio: $\frac{w}{e} \leq 4, 2$

w = core width

e = web thickness

l_c = core distance ≥ 100 mm

l_p = prestressing steel ≥ 100 mm

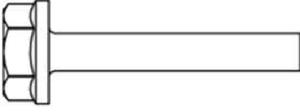
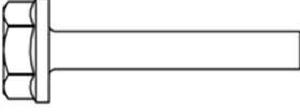
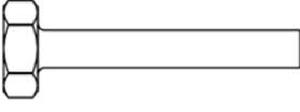
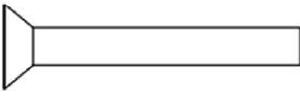
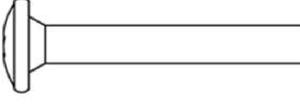
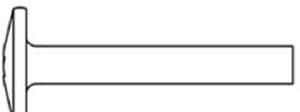
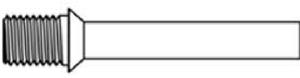
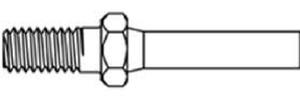
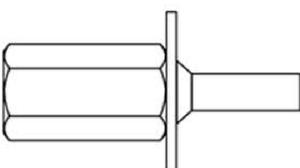
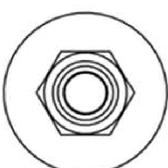
a_p = distance between anchor position and prestressing steel ≥ 50 mm

Walraven concrete screw WCS1

Product description

Installed condition in precast prestressed hollow core slabs

Annex A2

		1. Configuration with metric connection thread and hexagon socket e.g. WCS1HS
		2. Configuration with metric connection thread and hexagon drive e.g. WCS1HD
		3. Configuration with washer and hexagon head e.g. WCS1H
		4. Configuration with washer, hexagon head and TORX drive e.g. WCS1HT
		5. Configuration with hexagon head e.g. WCS1HH
		6. Configuration with countersunk head and TORX drive e.g. WCS1C
		7. Configuration with pan head and TORX drive e.g. WCS1P
		8. Configuration with large pan head and TORX drive e.g. WCS1PL
		9. Configuration with countersunk head and connection thread e.g. WCS1MC
		10. Configuration with hexagon drive and connection thread e.g. WCS1M
		11. Configuration with internal thread and hexagon drive e.g. WCS1N

Walraven concrete screw WCS1

Product description
Screw types

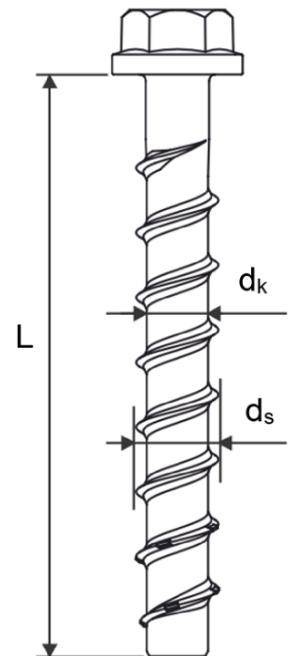
Annex A3

Table 1: Material

Part	Product name	Material		
all types	WCS1 concrete screw	- Steel EN 10263-4:2017 galvanized acc. to EN ISO 4042:2018 - Zinc flake coating according to EN ISO 10683:2018 ($\geq 5\mu\text{m}$)		
	WCS1 concrete screw A4	1.4401; 1.4404; 1.4571; 1.4578		
	WCS1 concrete screw HCR	1.4529		
Part	Product name	Nominal characteristic steel		Rupture elongation A_5 [%]
		Yield strength f_{yk} [N/mm ²]	Ultimate strength f_{uk} [N/mm ²]	
all types	WCS1 concrete screw	560	700	≤ 8
	WCS1 concrete screw A4			
	WCS1 concrete screw HCR			

Table 2: Dimensions

WCS1 concrete screw size			5	6
Screw length	$\leq L$	[mm]	200	
Core diameter	d_k	[mm]	4,0	5,1
Thread outer diameter	d_s	[mm]	6,5	7,5



Marking:

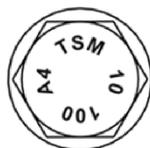
WCS1

Code: TSM
Screw size: 10
Screw length: 100



WCS1 A4

Code: TSM
Screw size: 10
Screw length: 100
Material: A4



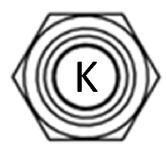
WCS1 HCR

Code: TSM
Screw size: 10
Screw length: 100
Material: HCR



Marking "k" or "x"

for anchors with connection thread and $h_{nom} = 35\text{mm}$



Walraven concrete screw WCS1

Product description

Material, Dimensions and markings

Annex A4

Specification of Intended use

Anchorage subject to:

- static and quasi static loads
- Used only for multiple use for non-structural application according to EN 1992-4:2018
- Used for anchorages with requirements related to resistance of fire (not for using in prestressed hollow core slabs): size 6
- Used for anchorages in prestressed hollow core slabs: size 6

Base materials:

- Reinforced and unreinforced concrete without fibers according to EN 206:2013.
- Strength classes C20/25 to C50/60 according to EN 206:2013.
- Cracked and uncracked concrete.

Use conditions (Environmental conditions):

- Concrete screws subject to dry internal conditions: all screw types.
- Structural subject to external atmospheric exposure (including industrial and marine environment) and to permanently damp internal condition no particular aggressive conditions exists: screw types made of stainless steel with marking A4.
- Structural subject to external atmospheric exposure (including industrial and marine environment) and to permanently damp internal condition if particular aggressive conditions exists: screw types made of stainless steel with marking HCR.

Note: Such particular aggressive conditions are e.g. permanent, alternating immersion in seawater or splash zone of seawater, chloride atmosphere of indoor swimming pools or atmosphere with chemical pollution (e.g. in desulphurization plants or road tunnels where de-icing materials are used).

Design:

- Anchorages are to be designed under the responsibility of an engineer experienced in anchorages and concrete work.
- 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 relative to reinforcement or to supports, etc.).
- Anchorages are designed according to EN 1992-4:2018 and EOTA Technical Report TR 055.
- The design for shear load according to EN 1992-4:2018, Section 6.2.2 applies for all specified diameters d_f of clearance hole in the fixture in Annex B2, Table 3.

Installation:

- Hammer drilling or hollow drilling.
- Anchor installation carried out by appropriately qualified personnel and under the supervision of the person responsible for technical matters on site.
- In case of aborted hole: new drilling must be drilled at a minimum distance of twice the depth of aborted hole or closer, if the aborted hole is filled with high strength mortar and only if the hole is not in the direction of the oblique tensile or shear load.
- After installation further turning of the anchor must not be possible. The head of the anchor is supported in the fixture and is not damaged.

TOGE concrete screw TSM High Performance

Intended use
Specification

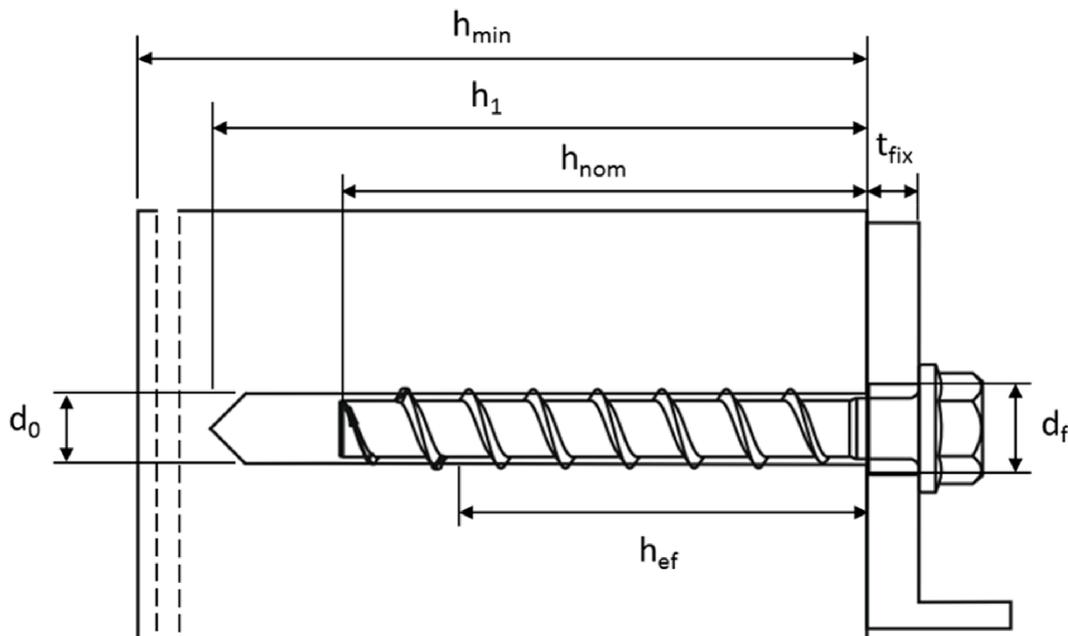
Annex B1

Table 3: Installation Parameters

WCS1 concrete screw size			5	6	
Nominal embedment depth	h_{nom}		h_{nom1}	h_{nom1}	h_{nom2}
	[mm]		35	35	55
Nominal drill hole diameter	d_0	[mm]	5	6	
Cutting diameter of drill bit	$d_{cut} \leq$	[mm]	5,40	6,40	
Drill hole depth	$h_1 \geq$	[mm]	40	40	60
Clearance hole diameter	$d_f \leq$	[mm]	7	8	
Installation torque (version with connection thread)	$T_{inst} \leq$	[Nm]	8	10	
Recommended torque impact screw driver	[Nm]	Max. torque according to manufacturer's instructions			
		110	160		

Table 4: Minimum thickness of member, minimum edge distance and minimum spacing

WCS1 concrete screw size			5	6	
Nominal embedment depth	h_{nom1}		h_{nom1}	h_{nom1}	h_{nom2}
	[mm]		35	35	55
Minimum thickness of member	h_{min}	[mm]	80	80	100
Minimum edge distance	c_{min}	[mm]	35	35	40
Minimum spacing	s_{min}	[mm]	35	35	40

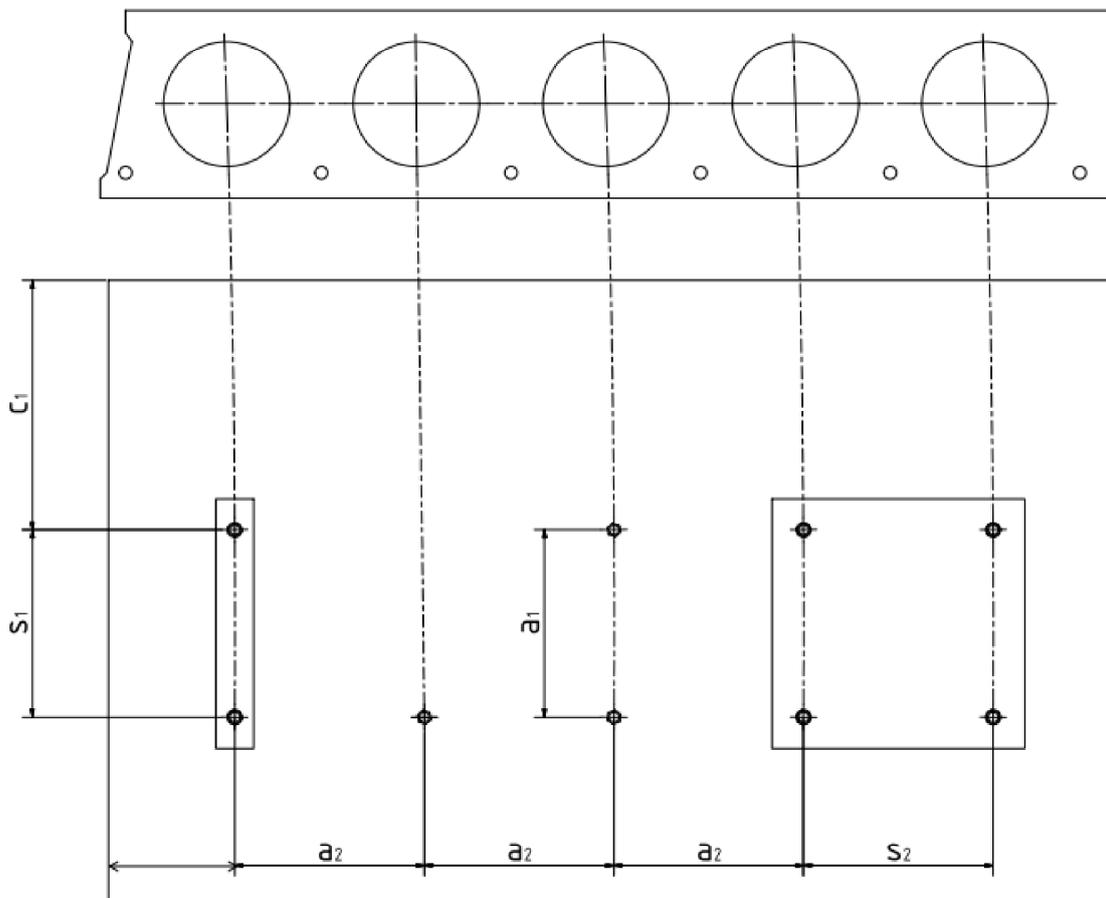


Walraven concrete screw WCS1

Intended use
Installation parameters

Annex B2

Installation parameters for anchorages in precast prestressed hollow core slabs



c_1, c_2 = edge distance

s_1, s_2 = anchor spacing

a_1, a_2 = distance between anchor groups

c_{min} = minimum edge distance ≥ 100 mm

s_{min} = minimum anchor spacing ≥ 100 mm

a_{min} = minimum distance between anchor groups ≥ 100 mm

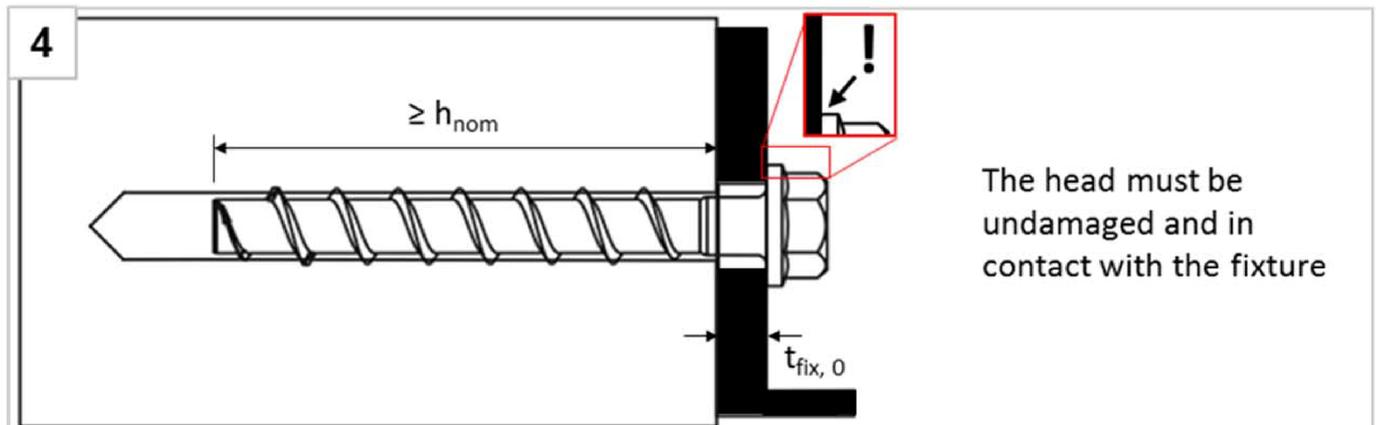
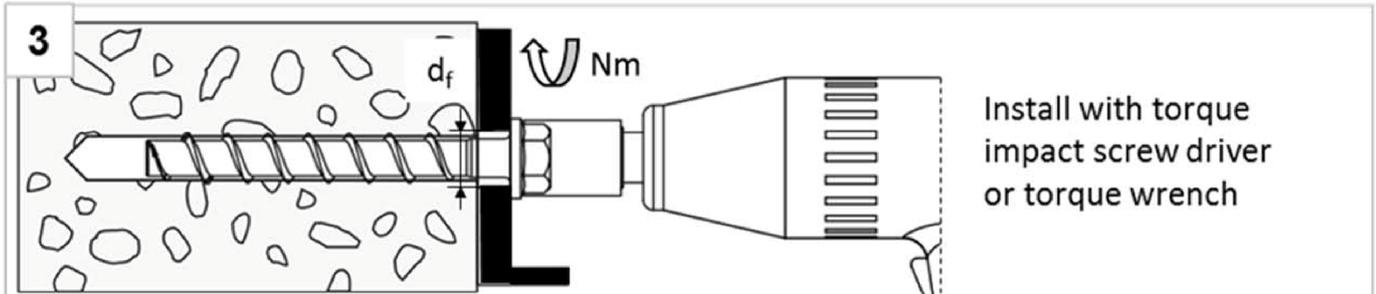
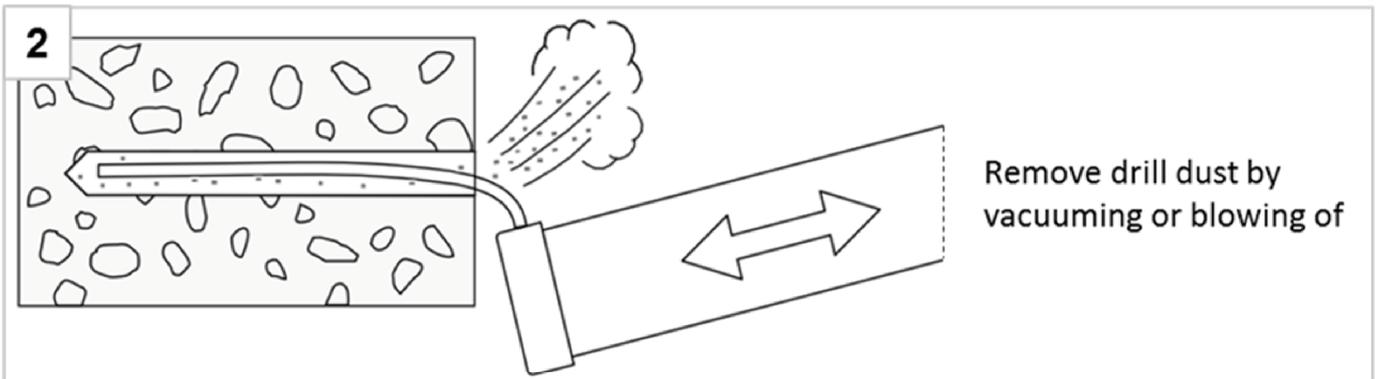
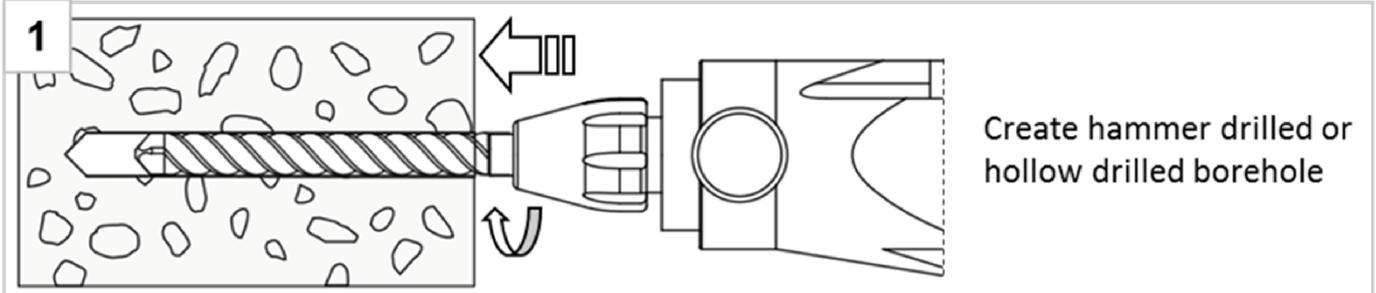
Walraven concrete screw WCS1

Intended use

Installation parameters for anchorages in precast prestressed hollow slabs

Annex B3

Installation Instructions

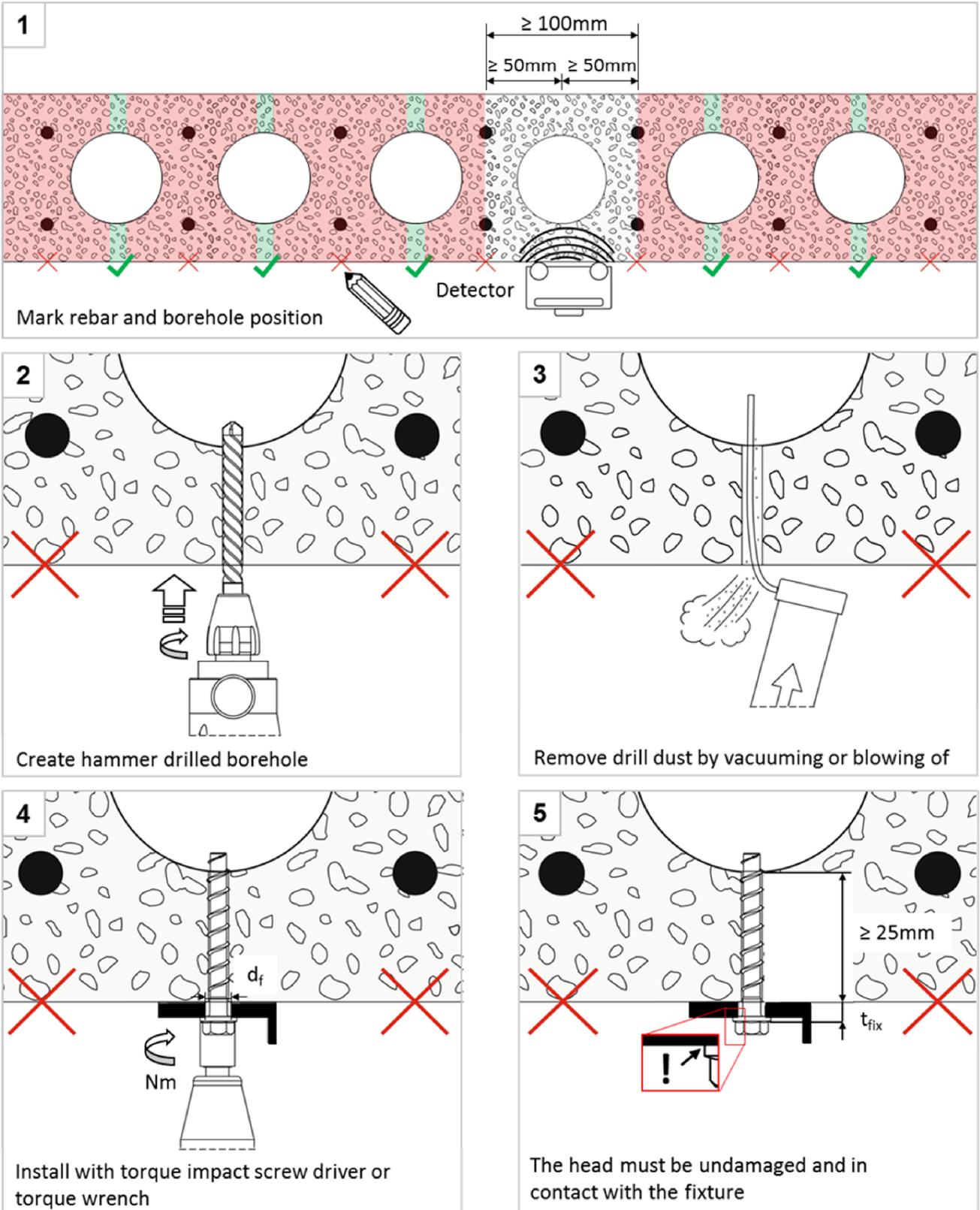


Walraven concrete screw WCS1

Intended use
Installation instructions

Annex B4

Installation Instructions for anchorages in prestressed hollow slabs



Walraven concrete screw WCS1

Intended use

Installation instructions for anchorages in prestressed hollow slabs

Annex B5

Table 5: Characteristic values for static and quasi-static loading

WCS1 concrete 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 loading						
Characteristic tension load	$N_{Rk,s}$	[kN]	8,7	14,0		
Partial factor tension load	$\gamma_{Ms,N}$	[-]	1,5			
Characteristic shear load	$V_{Rk,s}$	[kN]	4,4	7,0		
Partial factor shear load	$\gamma_{Ms,V}$	[-]	1,25			
Ductility factor	k_7	[-]	0,8			
Characteristic bending load	$M^0_{Rk,s}$	[Nm]	5,3	10,9		
Pull-out failure						
Characteristic tension load C20/25	cracked	$N_{Rk,p}$	[kN]	1,5	3,0	7,5
	uncracked	$N_{Rk,p}$	[kN]	1,5	3,0	7,5
Increasing factor for $N_{Rk,p}$	C20/25	Ψ_c	[-]	1,12		
	C30/37			1,22		
	C40/50			1,41		
	C50/60			1,58		
Concrete failure: Splitting failure, concrete cone failure and pry-out failure						
Effective embedment depth	h_{ef}	[mm]	27	27	44	
k-factor	cracked	$k_1 = k_{cr}$	[-]	7,7		
	uncracked	$k_1 = k_{ucr}$	[-]	11,0		
Concrete cone failure	spacing	$s_{cr,N}$	[mm]	$3 \times h_{ef}$		
	edge distance	$c_{cr,N}$	[mm]	$1,5 \times h_{ef}$		
Splitting failure	spacing	$s_{cr,Sp}$	[mm]	120	120	160
	edge distance	$c_{cr,Sp}$	[mm]	60	60	80
Factor for pry-out failure	k_8	[-]	1,0			
Installation factor	γ_{inst}	[-]	1,2	1,0	1,0	
Concrete edge failure						
Effective length in concrete	$l_f = h_{ef}$	[mm]	27	27	44	
Nominal outer diameter of screw	d_{nom}	[mm]	5	6		
Walraven concrete screw WCS1					Annex C1	
Performances Characteristic values for static and quasi-static loading						

Table 6: Characteristic values of resistance in precast prestressed hollow core slabs C30/37 to C50/60

WCS1 concrete screw size			6		
Bottom flange thickness	d_b	[mm]	≥ 25	≥ 30	≥ 35
Characteristic resistance	F_{Rk}^0	[kN]	1	2	3
Installation factor	γ_{inst}	[-]	1,0		

Table 7: Limiting distances for application in precast prestressed hollow core slabs

Distances for application in precast prestressed hollow core slabs			
Minimum edge distance	c_{min}	[mm]	≥ 100
Minimum anchor spacing	s_{min}	[mm]	≥ 100
Minimum distance between anchor groups	a_{min}	[mm]	≥ 100
Distance of core	l_c	[mm]	≥ 100
Distance of prestressing steel	l_p	[mm]	≥ 100
Distance between anchor position and prestressing steel	a_p	[mm]	≥ 50

Walraven concrete screw WCS1

Performances

Characteristic values and limiting distances in precast prestressed hollow core slabs

Annex C2

Table 8: Fire exposure – characteristic values of resistance ¹⁾

WCS1 concrete screw size				6			
Material				WCS1		WCS1 A4/HCR	
Nominal embedment depth		h_{nom}		h_{nom1}	h_{nom2}	h_{nom1}	h_{nom2}
		[mm]		35	55	35	55
Steel failure for tension and shear load ($F_{Rk,s,fi} = N_{Rk,s,fi} = V_{Rk,s,fi}$)							
Characteristic Resistance	R30	$F_{Rk,s,fi30}$	[kN]	0,9		1,2	
	R60	$F_{Rk,s,fi60}$	[kN]	0,8		1,2	
	R90	$F_{Rk,s,fi90}$	[kN]	0,6		1,2	
	R120	$F_{Rk,s,fi120}$	[kN]	0,4		0,8	
	R30	$M^0_{Rk,s,fi30}$	[Nm]	0,7		0,9	
	R60	$M^0_{Rk,s,fi60}$	[Nm]	0,6		0,9	
	R90	$M^0_{Rk,s,fi90}$	[Nm]	0,5		0,9	
	R120	$M^0_{Rk,s,fi120}$	[Nm]	0,3		0,6	
Pull-out failure							
Characteristic Resistance	R30-R90	$N_{Rk,p,fi}$	[kN]	0,75	1,875	0,75	1,875
	R120	$N_{Rk,p,fi}$	[kN]	0,6	1,5	0,6	1,5
Concrete cone failure							
Characteristic Resistance	R30-R90	$N^0_{Rk,c,fi}$	[kN]	0,86	2,76	0,86	2,76
	R120	$N^0_{Rk,c,fi}$	[kN]	0,68	2,21	0,68	2,21
Edge distance							
R30 - R120		$C_{cr,fi}$	[mm]	2 x h_{ef}			
In case of fire attack from more than one side, the minimum edge distance shall be ≥ 300 mm.							
Spacing							
R30 - R120		$S_{cr,fi}$	[mm]	4 x h_{ef}			
Pry-out failure							
R30 - R120		k_8	[-]	1,0			
The anchorage depth has to be increased for wet concrete by at least 30 mm compared to the given value.							

¹⁾ Not for application in prestressed hollow core slabs

Walraven concrete screw WCS1

Performances
Characteristic values under fire exposure

Annex C3