

Approval body for construction products
and types of construction

Bautechnisches Prüfamt

An institution established by the Federal and
Laender Governments



European Technical Assessment

ETA-18/1160
of 5 January 2022

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

HUS4 Bonded screw

Product family
to which the construction product belongs

Bonded screw fastener for use in concrete

Manufacturer

HILTI Corporation
Feldkircherstraße 100
9494 SCHAAN
FÜRSTENTUM LIECHTENSTEIN

Manufacturing plant

Hilti Plants

This European Technical Assessment
contains

20 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 332795-00-0601 Edition 12/2021

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Specific Part

1 Technical description of the product

The HUS4 Bonded screw consists of a foil capsule HUS4-MAX and a steel element HUS4 according to Annex A1. The anchor made of galvanized steel is screwed into a predrilled cylindrical drill hole, filled with a mortar capsule HUS4-MAX. 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.

Product and product description are given in Annex A.

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

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

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

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

3.1 Mechanical resistance and stability (BWR 1)

Essential characteristic	Performance
Characteristic resistance to tension load (static and quasi-static loading)	See Annex B4, C1
Characteristic resistance to shear load (static and quasi-static loading)	See Annex C2
Characteristic resistance for simplified design	No performance assessed
Displacements (static and quasi-static loading)	See Annex C5
Characteristic resistance and displacements for seismic performance category C1	See Annex C3
Characteristic resistance and displacements for seismic performance category C2	No performance assessed

3.2 Safety in case of fire (BWR 2)

Essential characteristic	Performance
Reaction to fire	Class A1
Resistance to fire	See Annex C4

3.3 Aspects of durability linked with the basic works requirements

See Annex B1.

English translation prepared by DIBt

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. 332795-00-0601 the applicable European legal act is: [96/582/EC].

The system to be applied is: 1

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

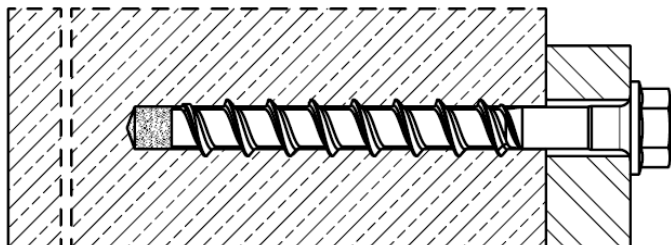
Technical details necessary for the implementation of the AVCP system are laid down in the control plan deposited at Deutsches Institut für Bautechnik.

Issued in Berlin on 5 January 2022 by Deutsches Institut für Bautechnik

Dipl.-Ing. Beatrix Wittstock
Head of Section

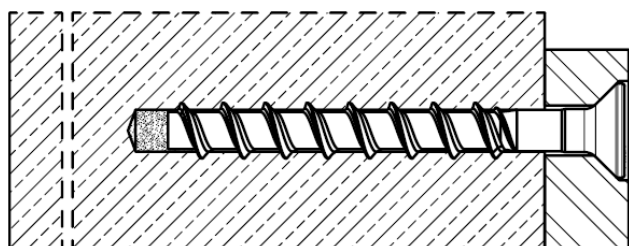
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Installed condition without adjustment

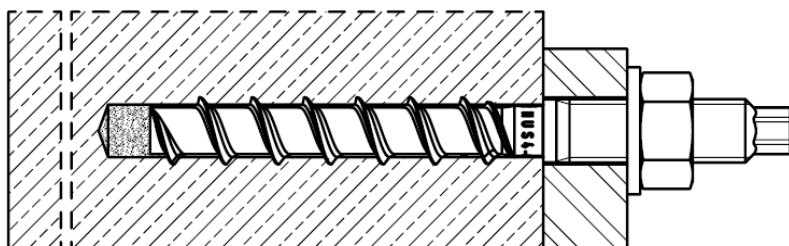


HUS4-H (hexagon head configuration sizes 10, 12 and 14)

HUS4-HF (hexagon head configuration sizes 10 and 14)



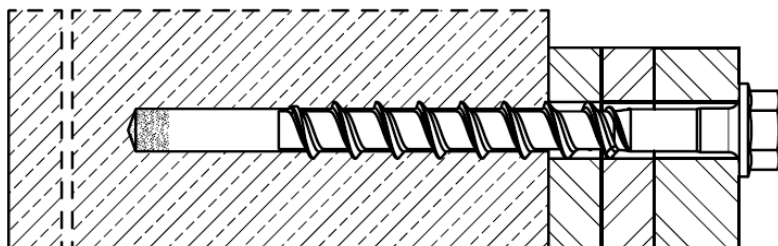
HUS4-C (countersunk head configuration size 10)



HUS4-A
(threaded rod connection sizes 10 with M12 and 14 with M16)

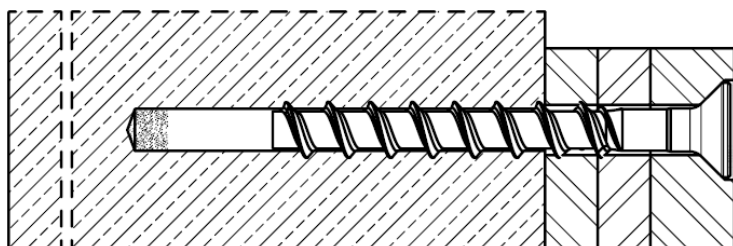
HUS4-AF
(threaded rod connection sizes 10 with M12 and 14 with M16)

Installed condition with adjustment



HUS4-H (hexagon head configuration sizes 10, 12, and 14)

HUS4-HF (hexagon head configuration sizes 10, and 14)



HUS4-C (countersunk head configuration size 10)

HUS4 Bonded screw

Product description
Installed condition

Annex A1

Product description: Foil capsule and steel elements

Foil capsule HUS4-MAX size 10 to 14: resin and hardener

Marking:
HUS4-MAX size
Expiry date mm/yyyy



Table A1: Screw types

<p>Hilti HUS4-H, sizes 10, 12 and 14, hexagonal head configuration, galvanized Hilti HUS4-HF, sizes 10 and 14, hexagonal head configuration, multilayer coating</p>
<p>Hilti HUS4-C, size 10, countersunk head configuration, galvanized</p>
<p>Hilti HUS4-A, size 10 with external thread M12 and size 14 with external thread M16, galvanized Hilti HUS4-AF, size 10 with external thread M12 and size 14 with external thread M16, multilayer coating</p>

HUS4 Bonded screw

Product description
Foil capsule / Steel elements

Annex A2

Table A2: Materials

Part	Material
HUS4 screw anchor (all types see Table A1)	Carbon steel Rupture elongation $A_5 \leq 8\%$

Table A3: Fastener dimensions and marking HUS4-H(F)

Fastener size HUS4-		H(F) 10	H 12	H(F) 14
Nominal fastener diameter	d [mm]	10	12	14
Nominal embedment depth	h_{nom} [mm]	85	100	115
Effective embedment depth	h_{ef} [mm]	85	100	115
Length of screw (min / max)	L [mm]	90 / 305	130 / 150	130 / 150

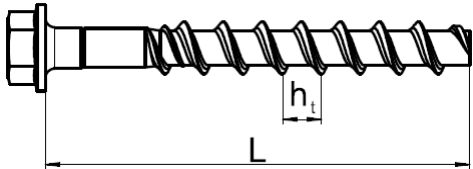

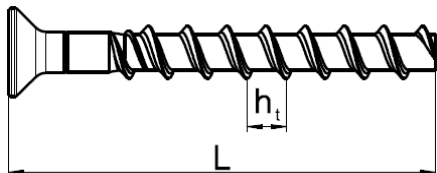

		<p>HUS4: Hilti Universal Screw 4th generation</p> <p>H: Hexagonal head, galvanized</p> <p>HF: Hexagonal head, multilayer coating</p> <p>10: Nominal screw diameter d [mm]</p> <p>100: Length of screw [mm]</p>
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Table A4: Fastener dimensions and marking HUS4-C

Fastener size HUS4-		C 10
Nominal fastener diameter	d [mm]	10
Nominal embedment depth	h_{nom} [mm]	85
Effective embedment depth	h_{ef} [mm]	85
Length of screw (min / max)	L [mm]	100 / 120

		<p>HUS4: Hilti Universal Screw 4th generation</p> <p>C: Countersunk head, galvanized</p> <p>10: Nominal screw diameter d [mm]</p> <p>100: Length of screw [mm]</p>
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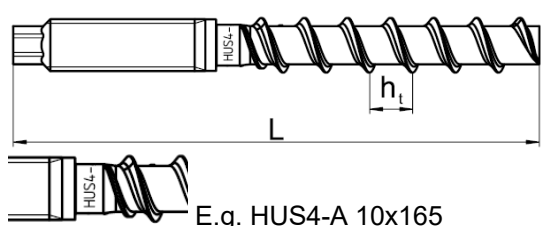

HUS4 Bonded screw

Product description
Materials and fastener dimensions

Annex A3

Table A5: Fastener dimensions and marking HUS4-A (AF)

Fastener size HUS4-A			A(F) 10	A(F) 14
Nominal fastener diameter	d	[mm]	10	14
Metric thread connection			M12	M16
Nominal embedment depth	h_{nom}	[mm]	85	115
Effective embedment depth	h_{ef}	[mm]	85	115
Length of screw (min / max)	L	[mm]	140 / 165	185 / 205

		HUS4: Hilti Universal Screw 4 th generation A: Thread connection, galvanized AF: Thread connection, multilayer coating 10: Nominal screw diameter d 165: Length of screw 8: Carbon steel K: Length identification HUS4-A 10x165			
		I	K	L	N
		10x140	10x165	14x185	14x205

HUS4 Bonded screw

Product description
Fastener dimensions

Annex A4

Specifications of intended use

Fastenings subject to:

- Static and quasi static loading
- Seismic performance category C1
- Fire exposure

Base material:

- Compacted reinforced or unreinforced normal weight concrete without fibres according to EN 206:2013 +A1:2016.
- Strength classes C20/25 to C50/60 according to EN 206-1:2010+A1:2016.
- Cracked or uncracked concrete.

Temperature in the base material:

- **at installation**
-10 °C to +40 °C
- **in-service**
Temperature range I: -40 °C to +120 °C
(max. long term temperature +72 °C and max. short term temperature +120 °C)

Use conditions (Environmental conditions):

- Fastenings subject to dry internal conditions.

Design:

- Fastenings are designed under the responsibility of an engineer experienced in fastenings and concrete work.
- Verifiable calculation notes and drawings are prepared taking account of the loads to be anchored. The position of the fastener is indicated on the design drawings (e. g. position of the fastener relative to reinforcement or to supports, etc.).
- The fastenings are designed in accordance with EN 1992-4:2018 and EOTA Technical Report TR 075:2021.
- In case of requirements to resistance to fire local spalling of the concrete cover must be avoided.

Installation:

- Concrete Condition I1: dry or wet concrete (not in flooded holes)
- Fastener installation carried out by appropriately qualified personnel and under the supervision of the person responsible for technical matters of the site.
- In case of aborted hole: new drilling at a minimum distance away of twice the depth of the aborted hole or smaller distance if the aborted hole is filled with high strength mortar and if under shear or oblique tension load it is not the direction of the load application.
- After installation further turning of the fastener must not be possible.
- The head of the fastener (HUS4-H and HUS4-C) must be supported on the fixture and is not damaged.



HUS4 Bonded screw

Intended Use
Specifications

Annex B1



Specifications of intended use: Drilling and cleaning

Table B1: Static and quasi static loading

HUS4		Fastener size
Uncracked or cracked concrete		
Hammer drilling (HD) ¹⁾	cleaned 	sizes 10 to 14
	not cleaned	
Hammer drilling with Hilti hollow drill bit TE-CD or TE-YD (HDB) ¹⁾ 		sizes 12 and 14



¹⁾ Adjustment is possible for sizes 10 to 14

Table B2: Seismic performance category C1

HUS4		Fastener size
Hammer drilling (HD) ¹⁾	cleaned 	sizes 10 to 14
	not cleaned	
Hammer drilling with Hilti hollow drill bit TE-CD or TE-YD (HDB) ¹⁾ 		sizes 12 and 14

¹⁾ Adjustment is possible for sizes 10 to 14

Table B3: Static and quasi static loading under fire exposure

HUS4		Fastener size
Hammer drilling (HD) ¹⁾	cleaned 	sizes 10 to 14
	not cleaned	
Hammer drilling with Hilti hollow drill bit TE-CD or TE-YD (HDB) ¹⁾ 		sizes 12 and 14

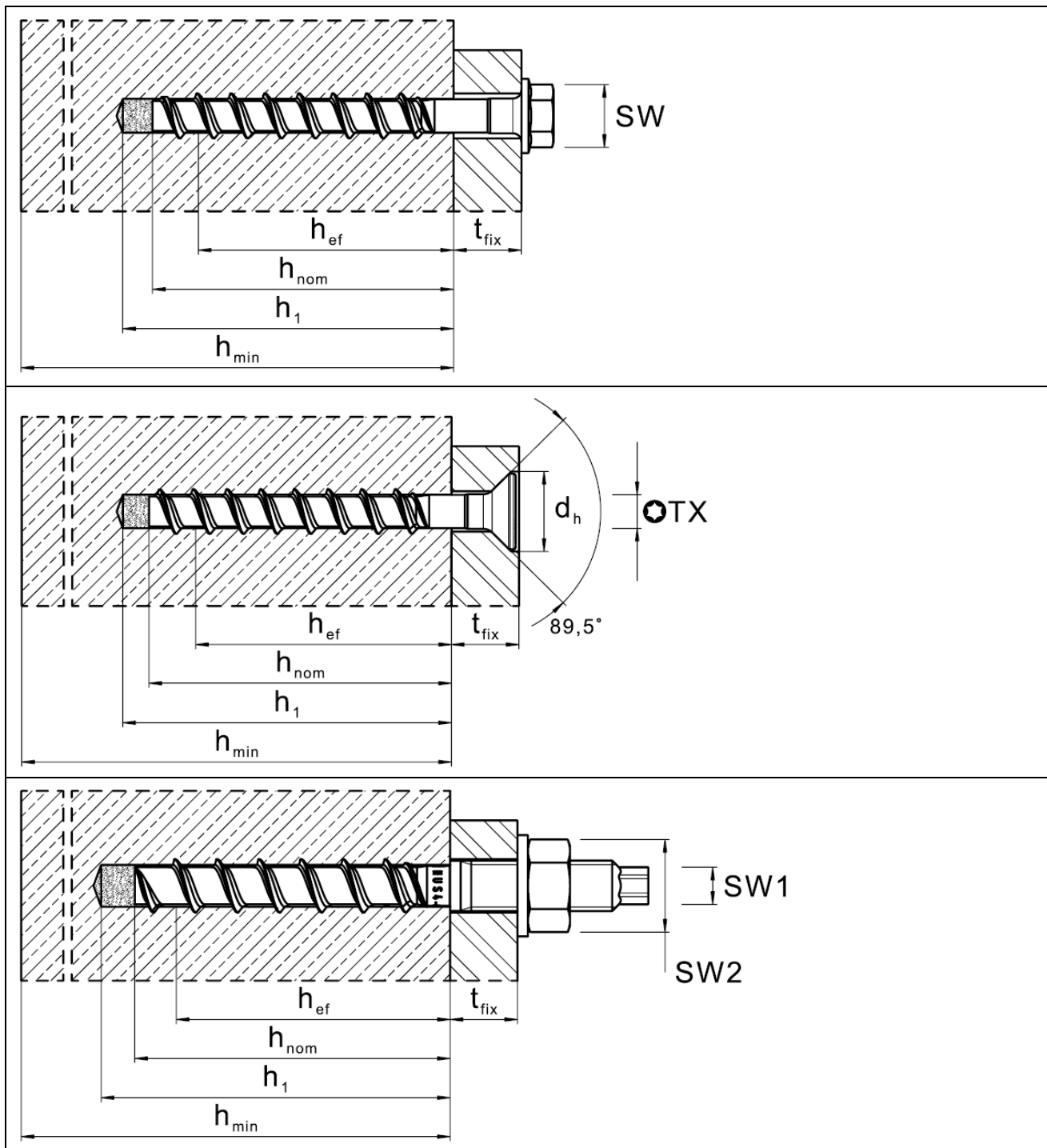
¹⁾ Adjustment is possible for sizes 10 to 14

HUS4 Bonded screw

Intended Use
Specifications

Annex B2

Installation parameters



Electronic copy of the ETA by DIBt: ETA-18/1160

HUS4 Bonded screw

Intended Use
Installation parameters

Annex B3

Table B1: Installation parameters HUS4 Bonded screw

Fastener size HUS4			10	12	14
Type			H, C, A	H	H, A
Nominal embedment depth	h_{nom}	[mm]	85	100	115
Nominal drill hole diameter	d_0	[mm]	10	12	14
Cutting diameter of drill bit	$d_{cut} \leq$	[mm]	10,45	12,50	14,50
Clearance hole diameter through setting	$d_f \leq$	[mm]	14	16	18
Clearance hole diameter pre setting (A-type)	$d_f \leq$	[mm]	14	-	18
Wrench size (H, HF-type)	s	[mm]	15	17	21
Wrench size for hex head (A-type)	s1	[mm]	8	-	12
Wrench size (A-type)	s2	[mm]	19	-	24
Maximum torque (A-type)	$\max T_{inst}$	[Nm]	20	-	80
Torx size (C-type)	TX	-	50	-	-
Diameter of countersunk head	d_h	[mm]	21	-	-
Depth of drill hole for cleaned hole or for uncleaned hole when drilling upwards	$h_1 =$	[mm]	$(h_{nom} + 10 \text{ mm})$		
			95	110	125
Depth of drill hole for uncleaned hole hammer drilling in wall and floor position	$h_1 =$	[mm]	$(h_{nom} + 10 \text{ mm}) + 2 * d_0$		
			115	134	153
Depth of drill hole (with adjustability) cleaned hole or for uncleaned hole when drilling upwards	$h_1 =$	[mm]	$(h_{nom} + 20 \text{ mm})$		
			105	120	135
Depth of drill hole (with adjustability) for uncleaned hole hammer drilling in wall and floor position	$h_1 =$	[mm]	$(h_{nom} + 20 \text{ mm}) + 2 * d_0$		
			125	144	163
Minimum thickness of concrete member	$h_{min} \geq$	[mm]	$(h_1 + 30 \text{ mm})$		
			140	160	200
Minimum spacing	$s_{min} \geq$	[mm]	40	50	60
Minimum edge distance	$c_{min} \geq$	[mm]	40	50	60
Setting tool ¹⁾			SIW 22T-A SIW 6 AT-A22 SIW 6.2 AT-A22 SIW 8.1 AT gear 1 SIW 9-A22	SIW 22T-A SIW 6.2 AT-A22 SIW 8.1 AT SIW 9-A22	

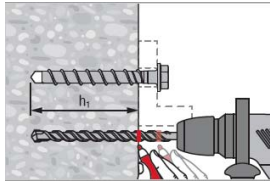
¹⁾ Installation with other impact screw driver of equivalent power is possible.

HUS4 Bonded screw	Annex B4
Intended Use Installation parameters	

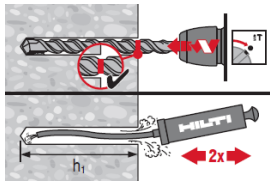
Installation

Hole drilling and cleaning

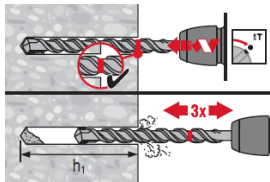
Hammer drilling (HD) all sizes



Mark drilling depth h_1 for drilling with or without fixture in place.
Details for drilling depth h_1 see table B4.



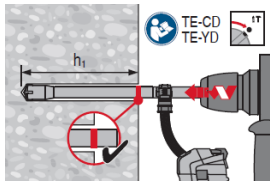
Cleaning needed in downward and horizontal installation direction with drill hole depth
 $h_1 = h_{nom} + 10 \text{ mm}$



No cleaning is required in upward installation direction.
No cleaning is allowed in downward and horizontal installation direction when 3x ventilation¹⁾ after drilling is executed.

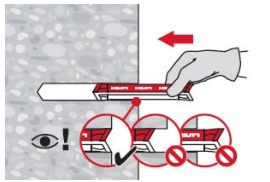
Drill hole depth $h_1 = h_{nom} + 10 \text{ mm} + 2 * d_0$
¹⁾ moving the drill bit in and out of the drill hole 3 times after the recommended drilling depth h_1 is achieved. This procedure shall be done with both revolution and hammer functions activated in the drilling machine. For more details read the relevant MPII.

Hammer drilling with Hilti hollow drill bit (HDB) TE-CD or TE-YD size 12 and 14.



No cleaning needed
 $h_1 = h_{nom} + 10 \text{ mm}$

Insert of HUS4-MAX foil capsule



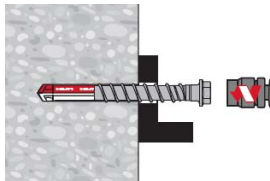
HUS4 Bonded screw

Intended Use
Installation instructions

Annex B5

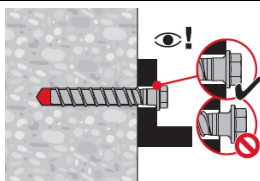
Fastener setting without adjustment

Setting by impact screw driver



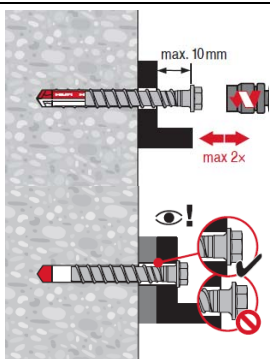
Setting parameters listed in Table B1

Setting check



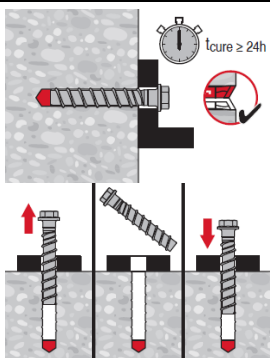
Fastener setting with adjustment

Adjusting process 1



A screw can get adjusted maximum two times. The total allowed thickness of shims added during the adjustment process is 10 mm. The final embedment depth after adjustment process must be larger or equal than h_{nom} .

Adjusting process 2

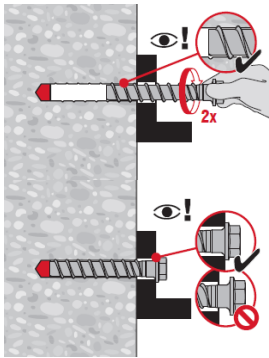


After minimum curing time of 24 h the HUS4 screw can screw out and in for 1 time.

HUS4 Bonded screw

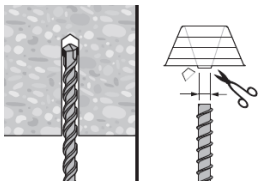
Intended Use
Installation instructions

Annex B6

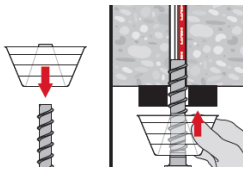


Find the thread in the drilled hole
The screw should be screw in 2 revolutions by hand and finish
with the setting tool.

Overhead installation



For upward installation direction use the overhead dripping cup
HIT-OHC.



HUS4 Bonded screw

Intended Use
Installation instructions

Annex B7

Table C1: Essential characteristics for HUS4 Bonded screw under tension load in case of static and quasi static loading

HUS4-MAX with HUS4 screw			10 (H; A; C)	12 (H)	14 (H; A)
Nominal embedment depth	h_{nom}	[mm]	85	100	115
Installation factor	γ_{inst}	[-]	1,0	1,0	1,0
Adjustment					
Total max. thickness of adjustment layers	t_{adj}	[mm]	10	10	10
Max. number of adjustments	n_a	[-]	2	2	2
Steel failure					
Characteristic resistance	$N_{Rk,s}$	[kN]	55,0	79,0	101,5
Partial factor	$\gamma_{Ms,N}^{1)}$	[-]	1,5		
Combined pull-out and concrete failure					
Uncracked concrete					
Temperature range I:	$N_{Rk,p,ucr}$	[kN]	36,0	55,0	65,0
Increasing factor for $N_{Rk,p,ucr} = N_{Rk,p,ucr(C20/25)} * \psi_c$	ψ_c	[-]	$(f_{ck}/20)^{0,30}$		
Cracked concrete					
Temperature range I:	$N_{Rk,p,cr}$	[kN]	22,0	34,0	38,0
Increasing factor for $N_{Rk,p,cr} = N_{Rk,p,cr(C20/25)} * \psi_c$	ψ_c	[-]	$(f_{ck}/20)^{0,50}$		
Sustained load factor	ψ_{sus}^0	[-]	0,94		
Concrete cone failure					
Effective embedment depth	h_{ef}	[mm]	85	100	115
Factor for uncracked concrete	$k_{ucr,N}$	[-]	11,0		
Factor for cracked concrete	$k_{cr,N}$	[-]	7,7		
Increasing factor for $N_{Rk,c} = N_{Rk,c(C20/25)} * \psi_c$	ψ_c	[-]	$(f_{ck}/20)^{0,50}$		
Edge distance	$c_{cr,N}$	[mm]	1,5 h_{ef}		
Spacing	$s_{cr,N}$	[mm]	3 h_{ef}		
Splitting failure					
Characteristic resistance	$N_{Rk,sp}^0$	[kN]	= $N_{Rk,p}$		
Edge distance	$c_{cr,sp}$	[mm]	1,6 h_{ef}	1,7 h_{ef}	1,85 h_{ef}
Spacing	$s_{cr,sp}$	[mm]	3,2 h_{ef}	3,4 h_{ef}	3,7 h_{ef}

¹⁾ In absence of other national regulations.

HUS4 Bonded screw

Performances

Essential characteristics under tension loads in case of static and quasi-static loading

Annex C1

Table C2: Essential characteristics for HUS4 Bonded screw under shear load in case of static and quasi static loading

HUS4-MAX with HUS4 screw			10 (H; A; C)	12 (H)	14 (H; A)
Nominal embedment depth	h_{nom}	[mm]	85	100	115
Steel failure for shear load					
Characteristic resistance	$V^{0}_{Rk,s}$	[kN]	32,0	44,9	62
Partial factor	$\gamma_{Ms,N}^{1)}$	[-]	1,25		
Ductility factor	k_7	[-]	0,8		
Characteristic resistance	$M^{0}_{Rk,s}$	[Nm]	64	125	186
Concrete pry-out failure					
Pry-out factor	k_8	[-]	2,0		
Concrete edge failure					
Effective length of fastener in shear loading	l_f	[mm]	85	100	115
Diameter of fastener	d	[mm]	10	12	14

¹⁾ In absence of other national regulations.

HUS4 Bonded screw

Performances

Essential characteristics under shear load in case of static and quasi static loading

Annex C2

Table C3: Essential characteristics for HUS4 Bonded screw seismic performance category C1 in concrete

HUS4-MAX with HUS4 screw		10 (H; A; C)	12 (H)	14 (H; A)
Nominal embedment depth	h_{nom} [mm]	85	100	115
Steel failure for tension and shear load				
Characteristic resistance	$N_{Rk,s,C1}$ [kN]	55,0	79,0	101,5
Partial factor	$\gamma_{Ms,N}^{1)}$ [-]	1,5		
Characteristic resistance	$V_{Rk,s,C1}$ [kN]	26,7	38,9	34,5
Partial factor	$\gamma_{Ms,V}^{1)}$ [-]	1,25		
Reduction factor acc. to EN 1992-4:2018	α_{gap} [-]	0,5		
Combined pullout and concrete cone failure Cracked concrete C20/25				
Temperature range I	$N_{Rk,p,C1}$ [kN]	20,9	34,0	38,0
Concrete cone failure				
Effective embedment depth	h_{ef} [mm]	85	100	115
Edge distance	$c_{cr,N}$ [mm]	1,5 h_{ef}		
Spacing	$s_{cr,N}$ [mm]	3 h_{ef}		
Robustness	γ_{inst} [-]	1,0		
Concrete pry-out failure				
Pry-out factor	k_8 [-]	2,0		
Concrete edge failure				
Effective length of fastener	$l_f = h_{ef}$ [mm]	85	100	115
Outside diameter of fastener	d_{nom} [mm]	10	12	14

¹⁾ In absence of other national regulations.

HUS4 Bonded screw

Performances

Essentials characteristics for seismic performance category C1 in concrete

Annex C3

Table C4: Essential characteristics under fire exposure in concrete for HUS4-Bonded screw

HUS4-MAX with HUS4 screw				10		12	14		
				H(F)	C 10	A(F)	H	H(F)	A(F)
Nominal embedment depth	h_{nom}	[mm]	85	85	85	100	115	115	
Steel failure for tension and shear load ($F_{Rk,s,fi} = N_{Rk,s,fi} = V_{Rk,s,fi}$)									
Characteristic resistance	R30	$F_{Rk,s,fi}$	[kN]	4,2	1,0	4,2	7,7	10,5	8,4
	R60	$F_{Rk,s,fi}$	[kN]	3,2	0,9	3,3	5,9	8,1	6,8
	R90	$F_{Rk,s,fi}$	[kN]	2,4	0,7	2,5	4,1	5,8	5,1
	R120	$F_{Rk,s,fi}$	[kN]	1,7	0,6	2,1	3,1	4,4	4,3
	R30	$M^0_{Rk,s,fi}$	[Nm]	4,9	1,2	4,8	11,6	19,3	15,4
	R60	$M^0_{Rk,s,fi}$	[Nm]	3,7	1,0	3,8	8,9	14,8	12,4
	R90	$M^0_{Rk,s,fi}$	[Nm]	2,7	0,8	2,9	6,2	10,7	9,3
	R120	$M^0_{Rk,s,fi}$	[Nm]	1,9	0,6	2,4	4,7	8,1	7,8
Pull-out failure									
Characteristic resistance	R30	$N^0_{Rk,p,fi}$	[kN]	5,5		8,5	9,5		
	R60								
	R90								
	R120								$N^0_{Rk,p,fi}$
Concrete cone failure									
Characteristic resistance	R30	$N^0_{Rk,c,fi}$	[kN]	11,4		17,2	24,4		
	R60								
	R90								
	R120								$N^0_{Rk,c,fi}$
Edge distance									
R30 to R120		$C_{cr,fi}$	[mm]	2 h_{ef}					
In case of fire attack from more than one side, the minimum edge distance shall be ≥ 300 mm									
Fastener spacing									
R30 to R120		$S_{cr,fi}$	[mm]	2 h_{ef}					
Concrete pry-out failure									
R30 to R120		k_8	[-]	2,0					
The embedment depth shall be increased for wet concrete by at least 30 mm compared to the given value									

HUS4 Bonded screw

Performances
Essential characteristics under fire exposure in concrete

Annex C4

Table C5: Displacements under tension load ¹⁾ for HUS4 Bonded screw in case of static and quasi static loading

HUS4 MAX with HUS4 screw			10 (H; A; C)		12 (H)		14 (H; A)	
			Uncracked concrete	Cracked concrete	Uncracked concrete	Cracked concrete	Uncracked concrete	Cracked concrete
Displacement	N	[kN]	17,1	10,5	23,8	16,2	31,0	18,1
	δ_{N0}	[mm]	0,3	0,3	0,4	0,5	0,5	0,6
	$\delta_{N\infty}$	[mm]	0,6	0,6	0,6	0,6	0,8	0,8

Table C6: Displacements under shear load ¹⁾ for HUS4 Bonded screw in case of static and quasi static loading

HUS4 MAX with HUS4 screw			10 (H; A; C)	12 (H)	14 (H; A)
Displacement	V	[kN]	18,3	25,7	35,4
	δ_{V0}	[mm]	1,0	0,9	4,0
	$\delta_{V\infty}$	[mm]	1,5	1,4	6,0

HUS4 Bonded screw

Performances
Displacements

Annex C5