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-13/1038 of 27 August 2015

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	Hilti screw anchor HUS3
Product family to which the construction product belongs	Concrete screw for use in concrete
Manufacturer	Hilti Aktiengesellschaft 9494 SCHAAN FÜRSTENTUM LIECHTENSTEIN
Manufacturing plant	Hilti Werke
This European Technical Assessment contains	23 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	Guideline for European technical approval of "Metal anchors for use in concrete", ETAG 001 Part 3: "Undercut anchors", April 2013, used as European Assessment Document (EAD) according to Article 66 Paragraph 3 of Regulation (EU) No 305/2011 and European Assessment Document (EAD) 330011-00-0601 "Assessment of adjustable concrete screws", July 2014.
This version replaces	ETA-13/1038 issued on 13 January 2015

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Specific Part

1 Technical description of the product

The Hilti screw anchor HUS3 is an anchor made of galvanised steel (HUS3-H, HUS3-HF, HUS3-C, HUS3-P. HUS3-PS, HUS3-A, HUS3-I) of sizes 6, 8, 10 and 14. 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 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)

Wesentliches Merkmal	**Leistung**
Characteristic resistance under static and quasi-static loading	See Annex C1 and C2
Characteristic resistance under seismic loading Category C1	See Annex C3
Displacements for tension and shear loads	See Annex C7

3.2 Safety in case of fire (BWR 2)

Essential characteristic	**Performance**
Reaction to fire	Anchorages satisfy requirements for Class A1
Resistance to fire	See Annex C4 – C6

3.3 Safety in use (BWR 4)

For Basic Works Requirement Safety in use the same criteria are valid as for Basic Works Requirement Mechanical resistance and stability.

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

In accordance with guideline for European technical approval ETAG 001, April 2013, used as European Assessment Document (EAD) according to Article 66 Paragraph 3 of Regulation (EU) No 305/2011, and European Assessment Document EAD 330011-00-0601 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 with Deutsches Institut für Bautechnik.

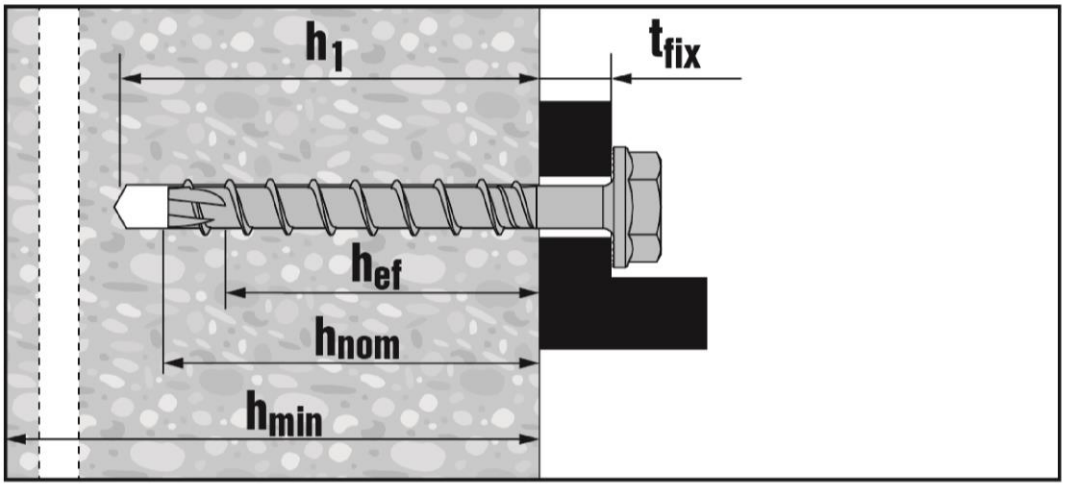
Issued in Berlin on 27 August 2015 by Deutsches Institut für Bautechnik

Uwe Bender
Head of Department

beglaubigt:
Baderschneider

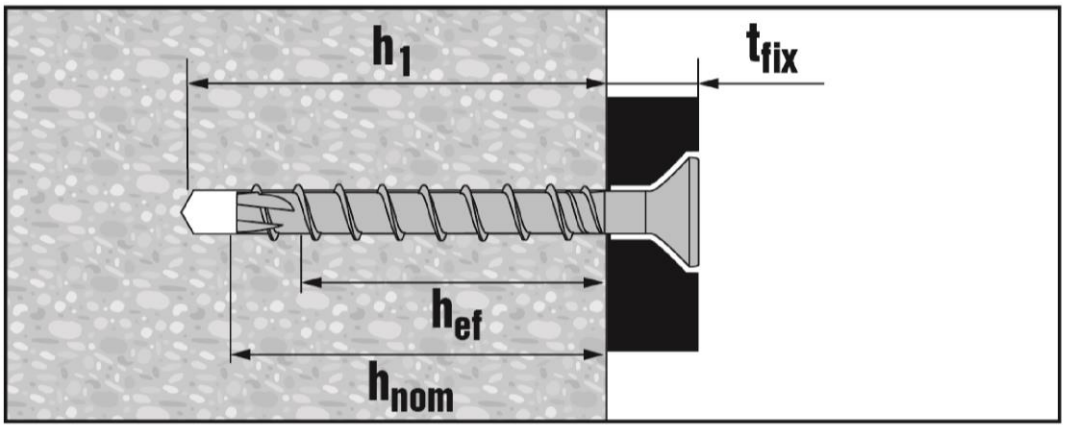
Deutsches Institut für Bautechnik

Product and installed condition without adjustment



HUS3-H (hexagon head configuration sizes 6, 8, 10 and 14)

HUS3-HF (hexagon head configuration sizes 8, 10 and 14)



HUS3-C (countersunk head configuration sizes 6, 8 and 10)

Hilti Screw anchor HUS3	Annex A1
Product description Installed condition without adjustment	

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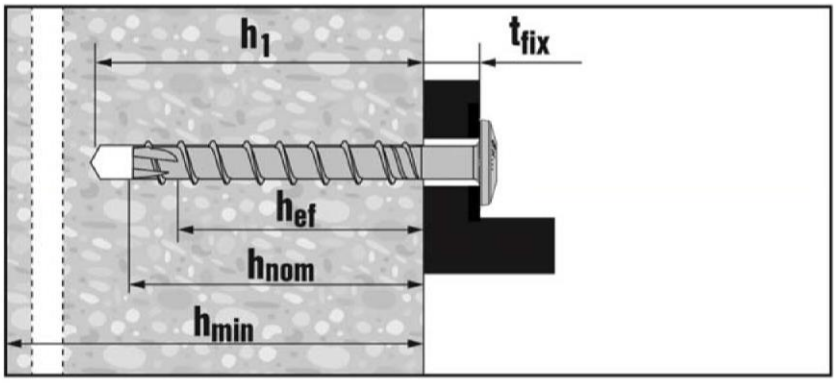
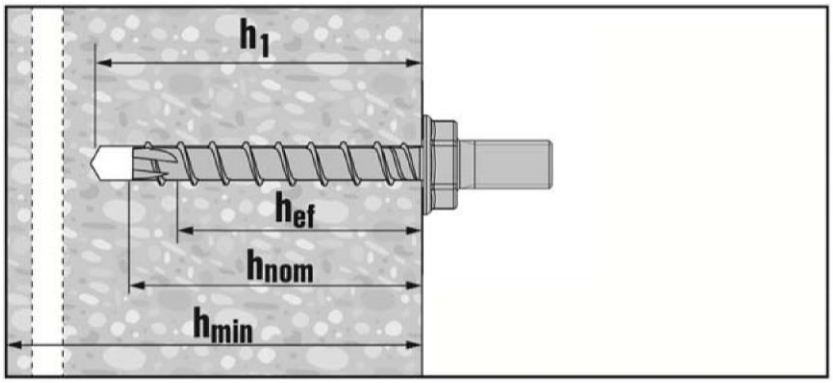
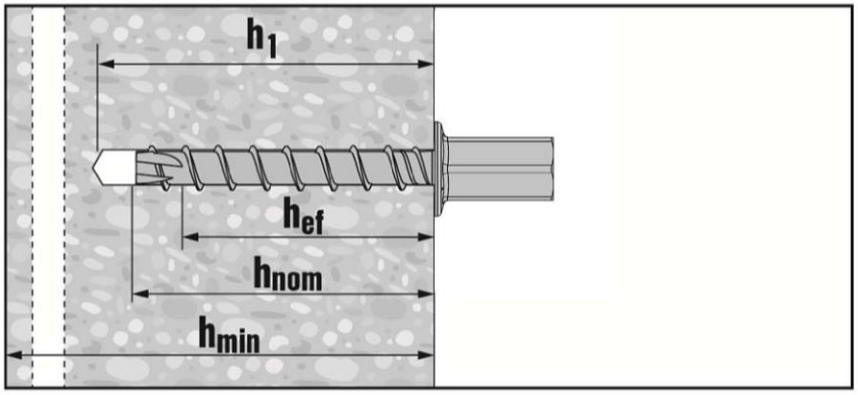
Product and installed condition without adjustment



HUS3-P/PS (pan head configuration size 6)



HUS3-A (size 6 with external thread configuration M8 or M10)



HUS3-I (size 6 with internal thread configuration M8/M10)

Hilti Screw anchor HUS3	Annex A2
Product description Installed condition without adjustment	

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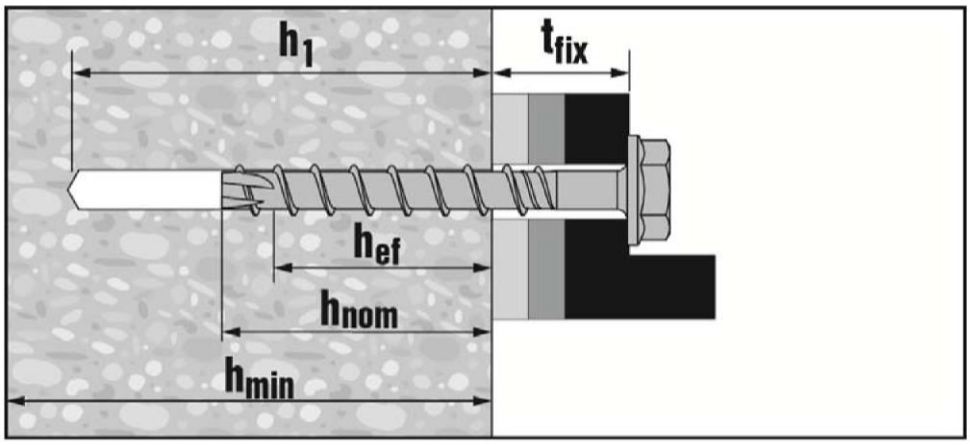
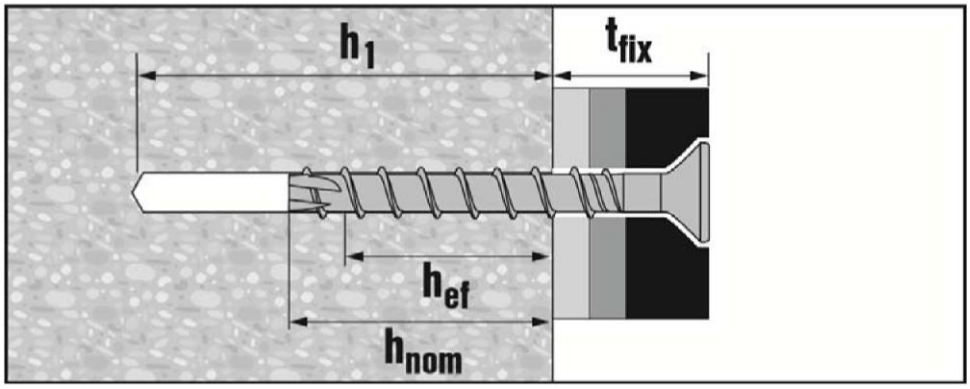
Product and installed condition with adjustment



HUS3-H (hexagon head configuration sizes 8 and 10 – h_{nom2})

HUS3-HF (hexagon head configuration sizes 8 and 10 – h_{nom2})



HUS3-C (countersunk head configuration sizes 8 and 10 – h_{nom2})

Hilti Screw anchor HUS3	Annex A3
Product description Installed condition with adjustment	

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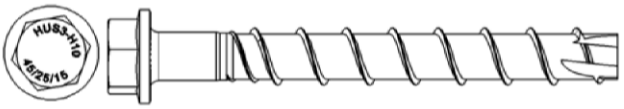
Table A1: Material and screw types

Part	Designation / Material
1, 2, 3, 4, 5, 6, 7.	Screw anchor / Carbon steel

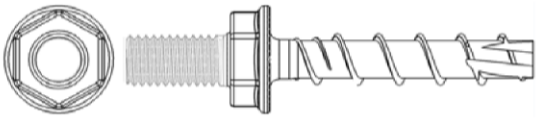
Anchor size HUS3			6	8	10	14
Characteristic yield strength	f_{yk}	[N/mm^2]	745	695	690	630
Characteristic ultimate strength	f_{uk}	[N/mm^2]	930	810	805	730
Elongation at rupture	A_5	[%]	≤8			



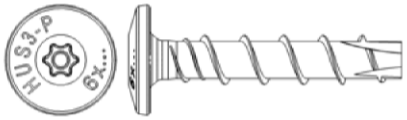
1) Hilti HUS3-H, sizes 6, 8,10 and 14, hexagonal head configuration, galvanized

2) Hilti HUS3-HF, sizes 8,10 and 14, hexagonal head configuration, multilayer coating

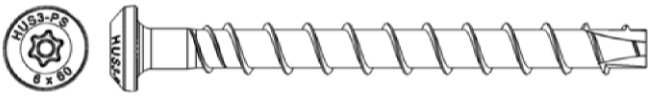
3) Hilti HUS3-C, sizes 6, 8 and 10, countersunk head configuration, galvanized



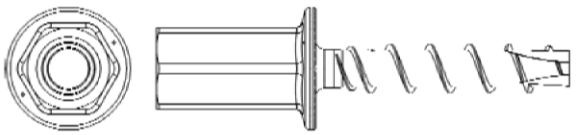
4) Hilti HUS3-A, size 6, external thread M8/16 and M10/21, galvanized



5) Hilti HUS3-P, size 6, pan head configuration, galvanized



6) Hilti HUS3-PS, size6, pan head (small) configuration, galvanized



7) Hilti HUS3-I, size 6, internal thread M8 and M10, galvanized

Hilti Screw anchor HUS3

Production description
Material and screw types

Annex A4

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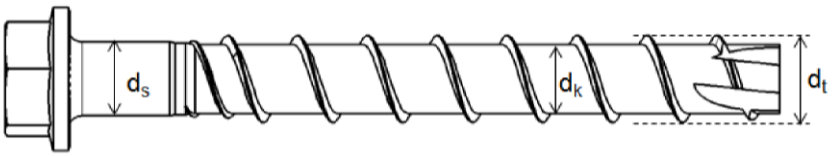
Table A2: Dimensions and marking

Anchor size HUS3 / **Type**			**6** **H, C, A, P, PS, I**	**8** **H, HF, C**			**10** **H, HF, C**			**14** **H, HF**		**H**
			h_{nom}	h_{nom1}	h_{nom2}	h_{nom3}	h_{nom1}	h_{nom2}	h_{nom3}	h_{nom1}	h_{nom2}	h_{nom3}
Nominal embedment depth		[mm]	55	50	60	70	55	75	85	65	85	115
Threaded outer diameter	d_t	[mm]	7,85	10,30			12,40			16,85		
Core diameter	d_k	[mm]	5,85	7,85			9,90			12,95		
Shaft diameter	d_s	[mm]	6,15	8,45			10,55			13,80		
Stressed section	A_s	[mm^2]	26,9	48,4			77,0			131,7		



HUS3 : Hilti Universal Screw 3rd generation

H : Hexagonal head

10 : screw diameter

45/25/15 : maximum thickness fixture $t_{fix1}/t_{fix2}/t_{fix3}$ related to the embedment depth $h_{nom1}/h_{nom2}/h_{nom3}$ (see Annex B4 and B5)

Hilti Screw anchor HUS3

Production description
Dimensions and screw types

Annex A5

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Specifications of intended use

Anchorages subject to:

- Static and quasi-static loads.
- Seismic action for Performance Category C1:
  HUS3-H sizes 8, 10 and 14, maximum embedment depth only (h_{nom3}).
  HUS3-C and HUS3-HF sizes 8 and 10, maximum embedment depth only (h_{nom3}).
- Fire exposure.

Base materials:

- Reinforced or unreinforced normal weight concrete according to EN 206:2013.
- Strength classes C20/25 to C50/60 according to EN 206:2013.
- Cracked or non-cracked concrete.

Use conditions (Environmental conditions)

- Anchorages subject to dry internal conditions.

Design:

- Anchorages are designed under the responsibility of an engineer experienced in anchorages and concrete work.
- Verifiable calculation notes and drawings are 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 under static or quasi-static actions are designed in accordance with:
  - ETAG 001, Annex C, design method A, Edition August 2010 or
  - CEN/TS 1992-4:2009, design method A
- Anchorages under seismic actions are designed in accordance with:
  - EOTA Technical Report TR 045, Edition February 2013
  - Anchorages shall be positioned outside of critical regions (e.g. plastic hinges) of the concrete structure.
  - Fastenings in stand-off installation or with a grout layer are not allowed.
- Anchorages under fire exposure are designed in accordance with:
  - ETAG 001, Annex C, design method A, Edition August 2010 and EOTA Technical Report TR 020, Edition May 2004 or
  - CEN/TS 1992-4:2009, Annex D
  - In case of requirements to resistance to fire local spalling of the concrete cover must be avoided.

Installation:

- Hammer drilling only.
- Anchor 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 anchor must not be possible.
- The head of the anchor must be supported on the fixture and is not damaged.
- Adjustability according to Annex B7 for:
  HUS3-H, HUS3-HF and HUS3-C size 8 (h_{nom2} = 60 mm)
  HUS3-H, HUS3-HF and HUS3-C size 10 (h_{nom2} = 75 mm)

Hilti Screw anchor HUS3	**Annex B1**
Intended Use Specifications	

Deutsches Institut für Bautechnik DIBt

Table B1: Installation parameters HUS3-6

Anchor size HUS3			**6**				
Type			**H**	**C**	**A**	**P- PS**	**I**
Nominal embedmenth depth		[mm]	55				
Nominal drill hole diameter	d_0	[mm]	6				
Cutting diameter of drill bit	$d_{cut} \leq$	[mm]	6,40				
Clearance hole diameter	$d_f \leq$	[mm]	9				
Wrench size (H, A, I -type)	SW	[mm]	13	-	13	-	13
Countersunk head diameter	d_h	[mm]	-	11,5			-
Torx size (C, P, PS –type)	TX	-	-	30	-	30	-
Depth of drill hole in floor/ wall position	$h_1 \geq$	[mm]	65				
Depth of drill hole in ceiling position	$h_1 \geq$	[mm]	58				
Installation Torque	T_{inst}	[Nm]	25				
Setting tool[1)]	Strength class	C20/25 and >20/25	Hilti SIW 14 A or Hilti SIW 22 A or				

Table B2: Installation parameters HUS3-8, 10 and 14

Anchor size HUS3			**8**			**10**			**14**		
Type			**H, HF, C**			**H, HF, C**			**H, HF**		**H**
			h_{nom1}	h_{nom2}	h_{nom3}	h_{nom1}	h_{nom2}	h_{nom3}	h_{nom1}	h_{nom2}	h_{nom3}
Nominal embedmenth depth	h_{nom}	[mm]	50	60	70	55	75	85	65	85	115
Nominal drill hole diameter	d_0	[mm]	8			10			14		
Cutting diameter of drill bit	$d_{cut} \leq$	[mm]	8,45			10,45			14,50		
Clearance hole diameter	$d_f \leq$	[mm]	12			14			18		
Wrench size (H, HF-type)	SW	[mm]	13			15			21		
Diameter of countersunk head	d_h	[mm]	18			21			-		
Torx size (C-type)	TX	-	45			50			-		
Depth of drill hole	$h_1 \geq$	[mm]	60	70	80	65	85	95	75	95	125
Depth of drill hole (with adjustability setting process)	$h_1 \geq$	[mm]	-	80	-	-	95	-	-		
Setting tool[1)]	Strength class	C20/25	Hilti SIW 14 A or Hilti SIW 22 A or Hilti SIW 22 T-A			Hilti SIW 22 A or Hilti SIW 22 T-A			Hilti SIW 22 T-A		
		> C20/25	Hilti SIW 22 T-A								

[1)] Installation with other impact screw driver of equivalente power is possible

Hilti Screw anchor HUS3

Intended Use
Installation parameter

Annex B2

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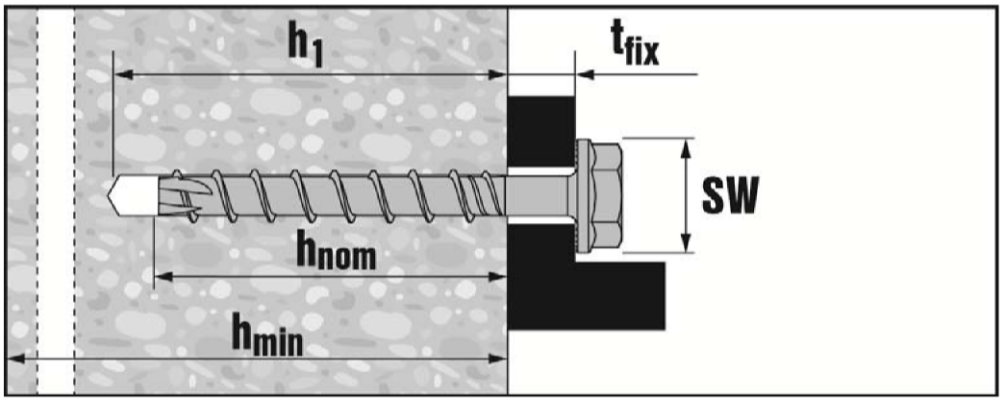
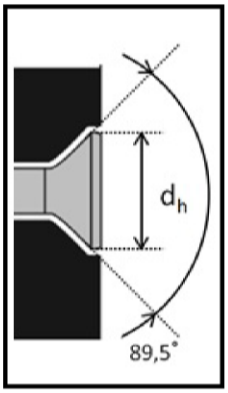
Table B3: Minimum thickness of concrete member, minimum edge distance and spacing HUS3-6

Anchor size HUS3				6
Nominal embedmenth depth		h_{nom}	[mm]	55
Minumum thickness of concrete member		h_{min}	[mm]	100
Cracked and non-cracked concrete	Minimum spacing	s_{min}	[mm]	35
	Minimum edge distance	c_{min}	[mm]	35

Table B4: Minimum thickness of concrete member, minimum edge distance and spacing HUS3-8, 10 und 14

Anchor size HUS3				8			10			14		
				h_{nom1}	h_{nom2}	h_{nom3}	h_{nom1}	h_{nom2}	h_{nom3}	h_{nom1}	h_{nom2}	h_{nom3}
Nominal embedmenth depth		h_{nom}	[mm]	50	60	70	55	75	85	65	85	115
Minumum thickness of concrete member		h_{min}	[mm]	100	100	120	100	130	140	120	160	200
Cracked and non-cracked concrete	Minimum spacing	s_{min}	[mm]	40	50	50	50	50	60	60	75	75
	Minimum edge distance	c_{min}	[mm]	50	50	50	50	50	60	60	75	75





Hilti Screw anchor HUS3

Intended Use
Minimum thickness of concrete member, minimum edge distance and spacing

Annex B3

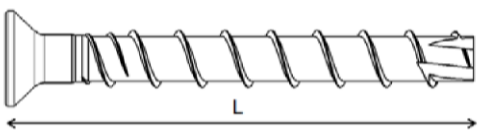
Deutsches Institut für Bautechnik DIBt

Table B5: Screw length and maximum thickness of fixture for HUS3-6

Anchor size	6					
	H	C	A	I	P	PS
embedment depth [mm]	55					
Length of screw [mm]	Thickness of fixture [mm]					
55			0	0		
60	5	5			5	5
70		15				
80	25				25	
100	45					
120	65					

Table B6: Screw length and maximum thickness of fixture for HUS3-C 8 and 10

Anchor size	8			10		
Nominal embedment depth [mm]	h_{nom1} 50	h_{nom2} 60	h_{nom3} 70	h_{nom1} 55	h_{nom2} 75	h_{nom3} 85
Length of screw [mm]	Thickness of fixture [mm]					
	t_{fix1}	t_{fix2}	t_{fix3}	t_{fix1}	t_{fix2}	t_{fix3}
65	15	5	-	-	-	-
70	-	-	-	15	-	-
75	25	15	-	-	-	-
85	35	25	15	-	-	-
90	-	-	-	35	15	-
100	-	-	-	45	25	15



Hilti Screw anchor HUS3

Intended Use
Screw length/ maximum thickness of fixture

Annex B4

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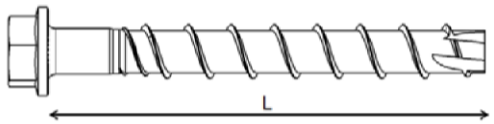
Table B7: Screw length and maximum thickness of fixture for HUS3-H and HUS3-HF[1)]

Anchor size	8			10			14		
Nominal embedment depth [mm] / Length of screw [mm]	h_{nom1} 50	h_{nom2} 60	h_{nom3} 70	h_{nom1} 55	h_{nom2} 75	h_{nom3} 85	h_{nom1} 65	h_{nom2} 85	h_{nom3} 115
	Thickness of fixture [mm]								
	t_{fix1}	t_{fix2}	t_{fix3}	t_{fix1}	t_{fix2}	t_{fix3}	t_{fix1}	t_{fix2}	t_{fix3}
55	5	-	-	-	-	-	-	-	-
60	-	-	-	5	-	-	-	-	-
65	15	5	-	-	-	-	-	-	-
70	-	-	-	15	-	-	-	-	-
75	25	15	5	-	-	-	10	-	-
80	-	-	-	25	5	-	-	-	-
85	35	25	15	-	-	-	-	-	-
90	-	-	-	35	15	5	-	-	-
100	50	40	30	45	25	15	35	15	-
110	-	-	-	55	35	25	-	-	-
120	70	60	50	-	-	-	-	-	-
130	-	-	-	75	55	45	65	45	15
150	100	90	80	95	75	65	85	65	35

1) HUS3-HF available for size 14 with h_1 and h_2 only



Hilti Screw anchor HUS3

Intended Use
Screw length/ maximum thickness of fixture

Annex B5

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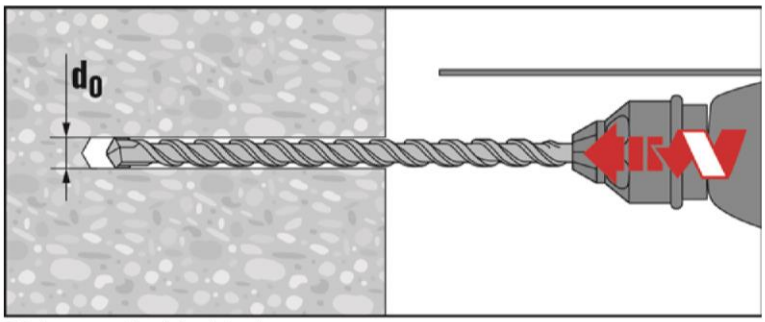
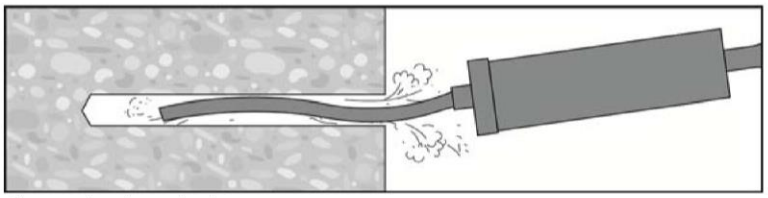
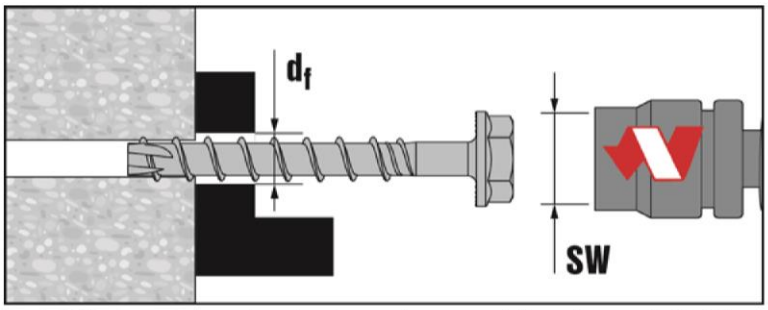
Installation instruction without adjustment



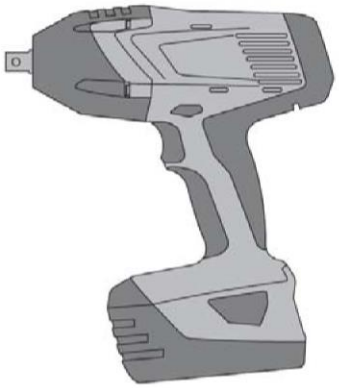
Make a cylindrical hole

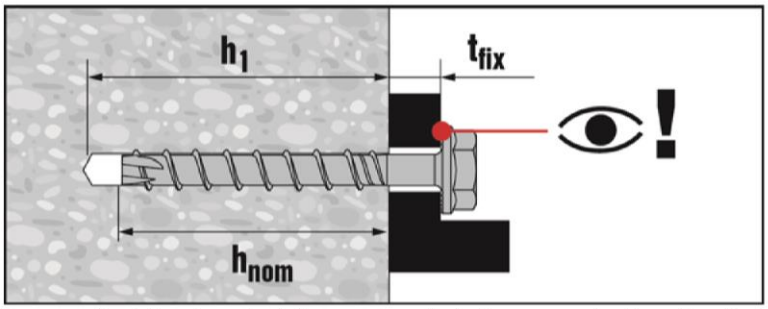


Clean the borehole



Install the screw anchor by impact screw driver (sizes 6, 8, 10 and 14) or by torque wrench (size 6)





Ensure that the head of the anchor is fully supported on the fixture and it is not damaged.

Hilti Screw anchor HUS3	**Annex B6**
Intended Use Installation Instruction without adjustment	

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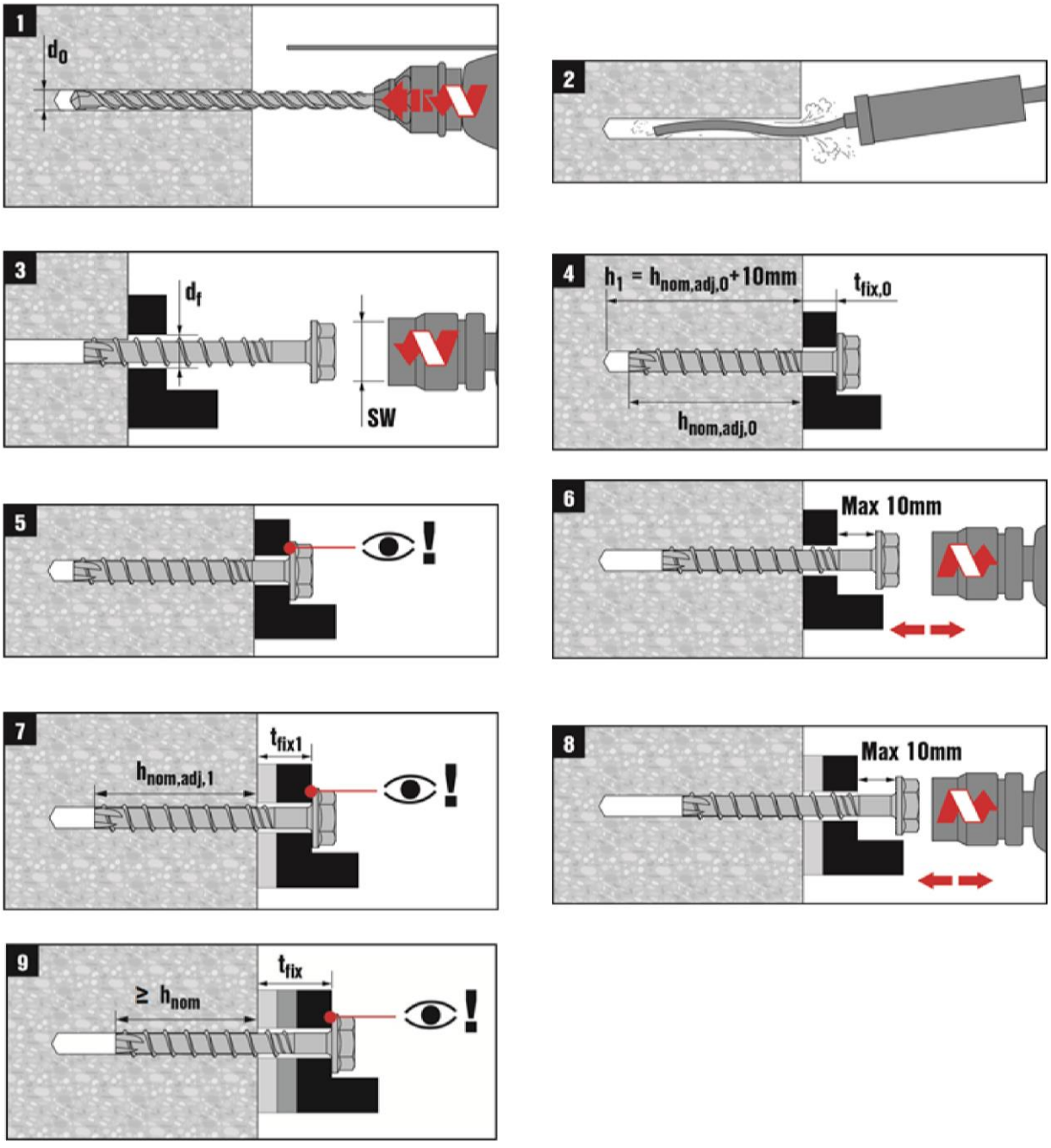
Installation instruction with adjustment



The anchor can be adjusted maximum two times.
The total allowed thickness of shims added during the adjustment process is 10mm.
The final embedment depth after adjustment process must be larger or equal than h_{nom2}.

Hilti Screw anchor HUS3	**Annex B7**
Intended Use Installation instruction with adjustment	

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Table C1: Characteristic values for static and quasi-static loads HUS3-6

Anchor size HUS3				6					
Type				H	C	A	I	P	PS
Nominal embedment depth		h_{nom}	[mm]	55					
Steel failure for tension and shear load									
Characteristic resistance		$N_{Rk,s}$	[kN]	24	22	24			21
		$V_{Rk,s}$	[kN]	12,5					
		k_2 [1]	[-]	0,8					
		$M^0_{Rk,s}$	[Nm]	21					
Pull-out failure									
Characteristic resistance in non-cracked concrete C20/25		$N_{Rk,p}$	[kN]	9				7,5	
Characteristic resistance in cracked concrete C20/25		$N_{Rk,p}$	[kN]	6					
Increasing factor concrete	C30/37	ψ_c	[-]	1,22					
	C40/50			1,41					
	C50/60			1,55					
Concrete cone and splitting failure									
Effective embedment depth		h_{ef}	[mm]	42					
Factor for	Cracked	k_{cr} [1]	[-]	7,2					
	Non-cracked	k_{ucr} [1]	[-]	10,1					
Concrete cone failure	Edge distance	$c_{cr,N}$	[mm]	1,5 h_{ef}					
	Spacing	$s_{cr,N}$	[mm]	3 h_{ef}					
Splitting failure	Edge distance	$c_{cr,sp}$	[mm]	63					
	Spacing	$s_{cr,sp}$	[mm]	126					
Installation safety factor		γ_2 [2] = γ_{inst} [1]	[-]	1,2					
Concrete pry-out failure									
k factor		k [2] = k_3 [1]	[-]	1,5					
Concrete edge failure									
Effective length of anchor		$l_f = h_{ef}$	[-]	42					
Outside diameter of anchor		d_{nom}	[mm]	6					

[1] Parameters relevant only for design according to CEN/TS 1992-4:2009
[2] Parameter relevant only for design according to ETAG001 Annex C

Hilti Screw anchor HUS3

Performances
Characteristic values for static and quasi-static loads

Annex C1

Deutsches Institut für Bautechnik DIBt

Table C2: Characteristic values for static and quasi-static loads HUS3-8, 10 and 14

Anchor size HUS3			**8**			**10**			**14**		
			h_{nom1}	h_{nom2}	h_{nom3}	h_{nom1}	h_{nom2}	h_{nom3}	h_{nom1}	h_{nom2}	h_{nom3}
Nominal embedment depth	h_{nom}	[mm]	50	60	70	55	75	85	65	85	115
Adjustment											
Total max. thickness of adjustment layers	t_{adj}	[mm]	-	10	-	-	10	-	-	-	-
Max. number of adjustments	n_a	[-]	-	2	-	-	2	-	-	-	-
Steel failure for tension and shear load											
Characteristic resistance	$N_{Rk,s}$	[kN]	39,2			62,2			96,6		
	$V_{Rk,s}$	[kN]	17			28			45		
	k_2 [2]	[-]	0,8								
	$M^0_{Rk,s}$	[Nm]	46			92			187		
Pull-out failure											
Characteristic resistance in non-cracked concrete C20/25	$N_{Rk,p}$	[kN]	9	12	16	12	20	[1]	[1]	[1]	[1]
Characteristic resistance in cracked concrete C20/25	$N_{Rk,p}$	[kN]	6	9	12	[1]	[1]	[1]	[1]	[1]	[1]
Increasing factor concrete C30/37	ψ_c	[-]	1,22								
Increasing factor concrete C40/50			1,41								
Increasing factor concrete C50/60			1,55								
Concrete cone and splitting failure											
Effective embedment depth	h_{ef}	[mm]	40	46,4	54,9	41,6	58,6	67,1	49,3	66,3	91,8
Factor for Cracked	k_{cr} [2]	[-]	7,2								
Factor for Non-cracked	k_{ucr} [2]	[-]	10,1								
Concrete cone failure Edge distance	$c_{cr,N}$	[mm]	1,5 h_{ef}								
Concrete cone failure Spacing	$s_{cr,N}$	[mm]	3 h_{ef}								
Splitting failure Edge distance	$c_{cr,sp}$	[mm]	60	70	85	65	90	110	85	100	140
Splitting failure Spacing	$s_{cr,sp}$	[mm]	120	140	170	130	180	220	170	200	280
Installation safety factor	γ_2 [3] = γ_{inst} [2]	[-]	1,0								
Concrete pry-out failure											
k factor	k [3] = k_3 [2]	[-]	1,0	2,0		1,0	2,0				
Concrete edge failure											
Effective length of anchor	$l_f = h_{ef}$	[-]	40	46,4	54,9	41,6	58,6	67,1	49,3	66,3	91,8
Outside diameter of anchor	d_{nom}	[mm]	8			10			14		

[1] Pull-out failure is not decisive
[2] Parameters relevant only for design according to CEN/TS 1992-4:2009
[3] Parameter relevant only for design according to ETAG001 Annex C

Hilti Screw anchor HUS3

Performances
Characteristic values for static and quasi-static loads

Annex C2

Deutsches Institut für Bautechnik DIBt

Table C3: Characteristic values for seismic category C1

Anchor size HUS3			**8** h_{nom3}	**10** h_{nom3}	**14** h_{nom3}
Nominal embedment depth	h_{nom}	[mm]	70	85	115
Steel failure for tension and shear load					
Characteristic resistance	$N_{Rk,s,seis}$	[kN]	39,2	62,2	96,6
	$V_{Rk,s,seis}$	[kN]	11,9	16,8	22,5
Pull-out failure					
Characteristic resistance in cracked concrete	$N_{Rk,p,seis}$	[kN]	12	1)	1)
Concrete cone failure					
Effective embedment depth	h_{ef}	[mm]	54,9	67,1	91,8
Concrete cone failure – Edge distance	$c_{cr,N}$	[mm]	1,5 h_{ef}		
Concrete cone failure – Spacing	$s_{cr,N}$	[mm]	3 h_{ef}		
Installation safety factor	γ_2	[-]	1,0		
Concrete pry-out failure					
k factor	k	[-]	2,0		
Concrete edge failure					
Effective length of anchor	$l_f = h_{ef}$	[-]	54,9	67,1	91,8
Outside diameter of anchor	d_{nom}	[mm]	8	10	14

1) Pull-out failure is not decisive.

Hilti Screw anchor HUS3

Performances
Characteristic values for seismic category C1

Annex C3

Deutsches Institut für Bautechnik DIBt

Table C4: Characteristic values for resistance to Fire HUS3-6

Anchor HUS3				**6**					
Type				**H**	**C**	**A**	**I**	**P**	**PS**
Nominal embedment depth		h_{nom}	[mm]	55					
Steel failure for tension and shear load ($F_{Rk,s,fi} = N_{Rk,s,fi} = V_{Rk,s,fi}$)									
Characteristic resistance	R30	$F_{Rk,s,fi}$	[kN]	1,6					
	R60	$F_{Rk,s,fi}$	[kN]	1,2					
	R90	$F_{Rk,s,fi}$	[kN]	0,8					
	R120	$F_{Rk,s,fi}$	[kN]	0,7					
	R30	$M^0_{Rk,s,fi}$	[Nm]	1,4					
	R60	$M^0_{Rk,s,fi}$	[Nm]	1,1					
	R90	$M^0_{Rk,s,fi}$	[Nm]	0,7					
	R120	$M^0_{Rk,s,fi}$	[Nm]	0,6					
Pull-out failure									
Characteristic resistance	R30 R60 R90	$N_{Rk,p,fi}$	[kN]	1,5					
	R120	$N_{Rk,p,fi}$	[kN]	1,2					
Concrete cone failure									
Characteristic resistance	R30 R60 R90	$N^0_{Rk,c,fi}$	[kN]	1,8					
	R120	$N^0_{Rk,c,fi}$	[kN]	1,5					
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.									
Anchor spacing									
R30 to R120		$s_{cr,fi}$	[mm]	$2\ c_{cr,fi}$					
Concrete pry-out failure									
R30 to R120		k	[-]	1,5					
The anchorage depth has to be increased for wet concrete by at least 30 mm compared to the given value.									

Hilti Screw anchor HUS3

Performances
Characteristic values for resistance to fire

Annex C4

Deutsches Institut für Bautechnik DIBt

Table C5: Characteristic values for resistance to Fire HUS3-H, HF sizes 8, 10 and 14

Anchor HUS3-H and HUS3-HF				**8**			**10**			**14**		
				h_{nom1}	h_{nom2}	h_{nom3}	h_{nom1}	h_{nom2}	h_{nom3}	h_{nom1}	h_{nom2}	h_{nom3}
Nominal embedment depth		h_{nom}	[mm]	50	60	70	55	75	85	65	85	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]	3,2	3,5	3,8	6,1	6,2		10,4	10,6	
	R60	$F_{Rk,s,fi}$	[kN]	2,4	2,6	2,8	4,6	4,7		7,8	8,1	
	R90	$F_{Rk,s,fi}$	[kN]	1,6	1,6	1,9	3,1	3,2		5,3	5,5	
	R120	$F_{Rk,s,fi}$	[kN]	1,2	1,2	1,5	2,4	2,5		4,0	4,3	
	R30	$M^0_{Rk,s,fi}$	[Nm]	14,6	15,9	17,2	35,2	35,6		78,9	79,8	
	R60	$M^0_{Rk,s,fi}$	[Nm]	11,0	11,7	13,0	26,6	27,1		59,6	60,7	
	R90	$M^0_{Rk,s,fi}$	[Nm]	7,4	7,4	8,8	18,0	18,6		40,2	41,7	
	R120	$M^0_{Rk,s,fi}$	[Nm]	5,7	5,3	6,8	13,7	14,4		30,6	32,1	
Pull-out failure												
Characteristic resistance	R30 R60 R90	$N_{Rk,p,fi}$	[kN]	1,5	2,3	3,0	2,4	4,0	4,9	3,1	4,8	7,8
	R120	$N_{Rk,p,fi}$	[kN]	1,2	1,8	2,4	1,9	3,2	3,9	2,5	3,8	6,3
Concrete cone failure												
Characteristic resistance	R30 R60 R90	$N^0_{Rk,c,fi}$	[kN]	1,8	2,6	4,0	2,0	4,7	6,6	3,0	6,4	14,4
	R120	$N^0_{Rk,c,fi}$	[kN]	1,4	2,1	3,2	1,6	3,8	5,3	2,4	5,1	11,5
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.												
Anchor spacing												
R30 to R120		$s_{cr,fi}$	[mm]	$2\ c_{cr,fi}$								
Concrete pry-out failure												
R30 to R120		k	[-]	1,0	2,0		1,0	2,0				
The anchorage depth has to be increased for wet concrete by at least 30 mm compared to the given value.												

Hilti Screw anchor HUS3

Performances
Characteristic values for resistance to fire

Annex C5

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Table C6: Characteristic values for resistance to Fire HUS3-C sizes 8 and 14

Anchor HUS3-C				**8**			**10**		
				h_{nom1}	h_{nom2}	h_{nom3}	h_{nom1}	h_{nom2}	h_{nom3}
Nominal embedment depth		h_{nom}	[mm]	50	60	70	55	75	85
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]	0,5			1,2		
	R60	$F_{Rk,s,fi}$	[kN]	0,4			1,0		
	R90	$F_{Rk,s,fi}$	[kN]	0,3			0,8		
	R120	$F_{Rk,s,fi}$	[kN]	0,2			0,6		
	R30	$M^0_{Rk,s,fi}$	[Nm]	0,6			1,7		
	R60	$M^0_{Rk,s,fi}$	[Nm]	0,5			1,5		
	R90	$M^0_{Rk,s,fi}$	[Nm]	0,4			1,1		
	R120	$M^0_{Rk,s,fi}$	[Nm]	0,3			0,9		
Pull-out failure									
Characteristic resistance	R30, R60, R90	$N_{Rk,p,fi}$	[kN]	1,5	2,3	3,0	2,4	4,0	5,0
	R120	$N_{Rk,p,fi}$	[kN]	1,2	1,8	2,4	1,9	3,2	4,0
Concrete cone failure									
Characteristic resistance	R30, R60, R90	$N^0_{Rk,c,fi}$	[kN]	1,8	2,6	4,0	2,0	4,7	6,6
	R120	$N^0_{Rk,c,fi}$	[kN]	1,5	2,1	3,2	1,6	3,8	5,3
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.									
Anchor spacing									
	R30 to R120	$s_{cr,fi}$	[mm]	2 $c_{cr,fi}$					
Concrete pry-out failure									
	R30 to R120	k	[-]	1,0	2,0		1,0	2,0	
The anchorage depth has to be increased for wet concrete by at least 30 mm compared to the given value.									

Hilti Screw anchor HUS3

Performances
Characteristic values for resistance to fire

Annex C6

Table C7: Displacements under tension load HUS3-6

Anchor size HUS3				**6**	
Type				**H, C, A. I**	**P, PS**
Nominal embedment depth		h_{nom}	[mm]	55	
Cracked concrete C20/25 to C50/60	Tension Load	N	[kN]	2,4	
	Displacement	δ_{N0}	[mm]	0,1	
		$\delta_{N\infty}$	[mm]	0,6	
		$\delta_{N,seis}$	[mm]	-	
Non-cracked concrete C20/25 to C50/60	Tension Load	N	[kN]	3,6	3,0
	Displacement	δ_{N0}	[mm]	0,2	
		$\delta_{N\infty}$	[mm]	0,3	

Table C8: Displacements under tension load HUS3-8, 10, 14

Anchor size HUS3				**8**			**10**			**14**		
				h_{nom1}	h_{nom2}	h_{nom3}	h_{nom1}	h_{nom2}	h_{nom3}	h_{nom1}	h_{nom2}	h_{nom3}
Nominal embedment depth				50	60	70	55	75	85	65	85	115
Cracked concrete C20/25 to C50/60	Tension Load	N	[kN]	4,3	5,7	7,6	5,7	9,5	13,2	8,3	13,0	21,2
	Displacement	δ_{N0}	[mm]	0,3	0,4	0,3	0,4	0,4	0,4	0,6	0,5	0,5
		$\delta_{N\infty}$	[mm]	0,7	0,7	0,6	0,4	0,4	0,5	0,9	1,2	1,0
		$\delta_{N,seis}$	[mm]	-	-	0,6	-	-	0,9	-	-	1,3
Non-cracked concrete C20/25 to C50/60	Tension Load	N	[kN]	6,6	8,9	11,8	8,7	14,8	20,5	12,9	20,1	32,8
	Displacement	δ_{N0}	[mm]	0,1	0,2	0,1	0,1	0,1	0,1	0,1	0,2	0,3
		$\delta_{N\infty}$	[mm]	0,3			0,2		s	0,5		

Table C9: Displacements under shear load HUS3-6, 8, 10 and 14

Anchor size HUS3				**6**	**8**			**10**			**14**		
				h_{nom}	h_{nom1}	h_{nom2}	h_{nom3}	h_{nom1}	h_{nom2}	h_{nom3}	h_{nom1}	h_{nom2}	h_{nom3}
Nominal embedment depth				55	50	60	70	55	75	85	65	85	115
Cracked concrete C20/25 to C50/60	Shear Load	V	[kN]	6,0	8,1			13,3			21,4		
	Displacement	δ_{V0}	[mm]	1,9	2,5	3,4	2,9	3,8	3,7	3,2	3,6	3,2	2,4
		$\delta_{V\infty}$	[mm]	2,8	3,7	5,1	4,4	5,7	5,5	4,9	5,4	6,9	3,5
		$\delta_{V,seis}$	[mm]	-	-	-	0,6	-	-	0,9	-	-	1,3

Hilti Screw anchor HUS3

Performances
Displacements

Annex C7