Designated according to The Construction Products (Amendment etc.) (EU Exit) Regulations 2020

UK Technical Assessment	UKTA-0836-23/6694 of 11/05/2023
Technical Assessment Body issuing the UK Technical Assessment:	British Board of Agrément
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 Feldkircherstrasse 100 9494 SCHAAN FÜRSTENTUM LIECHTENSTEIN
Manufacturing plant(s):	Hilti Plants
This UK Technical Assessment contains:	32 pages including 3 Annexes which form an integral part of this assessment.
This UK Technical Assessment is issued in accordance with The Construction Products (Amendment etc.) (EU Exit) Regulations 2020 on the basis of:	UKAD 330011-00-0601 Adjustable concrete screws and UKAD 330232-00-0601 Mechanical fasteners for use in concrete

1. Technical description of the product

The Hilti screw anchor HUS3 is an anchor made of galvanized steel (HUS3-H, HUS3-HF,HUS3-C, HUS3-P, HUS3-PS, HUS3-PL, HUS3-A, HUS3-I, HUS3-I Flex) 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(s) in accordance with the applicable UK Assessment Document (hereinafter UKAD)

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 UK 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) Method A	See Annexes B4, C1 – C3
Characteristic resistance to shear load (static and quasi-static loading)	See Annexes C1 and C3
Displacements and durability	See Annexes B1, C10 – C11
Characteristic resistance and displacements for seismic performance categories C1 and C2	See Annexes C4 – C6

3.2. Safety in case of fire (BWR 2)

Essential characteristic	Performance
Reaction to fire	Class A1
Resistance to fire	See Annexes C7 – C9

3.3. Health, hygiene and the environment (BWR 3)

Not relevant.

3.4. Safety and accessibility in use (BWR 4)

Not relevant.

3.5. Protection against noise (BWR 5)

Not relevant.

3.6. Energy economy and heat retention (BWR 6)

Not relevant.

3.7. Sustainable use of natural resources (BWR 7)

No performance assessed.

4. Assessment and verification of constancy of performance (hereinafter AVCP) system applied.

4.1. System of assessment and verification of constancy of performance

According to UKAD No. 330011-00-0601, UKAD No.330232-00-0601 and Annex V of the Construction Products Regulation (Regulation (EU) 305/2011) as brought into UK law and amended, the system of assessment and verification of constancy of performance (AVCP) 1 applies.

5. Technical details necessary for the implementation of the AVCP system, as provided for in the applicable UKAD

Technical details necessary for the implementation of the AVCP system are laid down in the control plan deposited with the British Board of Agrément and made available to the UK Approved Bodies involved in the conformity attestation process.

5.1. UKCA marking for the product/ system must contain the following information:

- Identification number of the Approved Body
- Name/address of the manufacturer of the product/ system
- Marking with intention of clarification of intended use
- Date of marking
- Number of certificate of constancy of performance (where applicable)
- UKTA number.

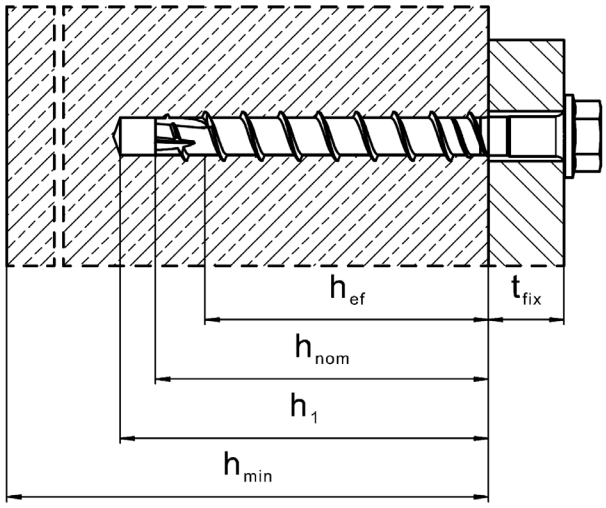
On behalf of the British Board of Agrément 	
Date of Issue: 11 May 2023	**Hardy Giesler** Chief Executive Officer

British Board of Agrément,
1st Floor Building 3,
Hatters Lane,
Croxley Park
Watford
WD18 8YG

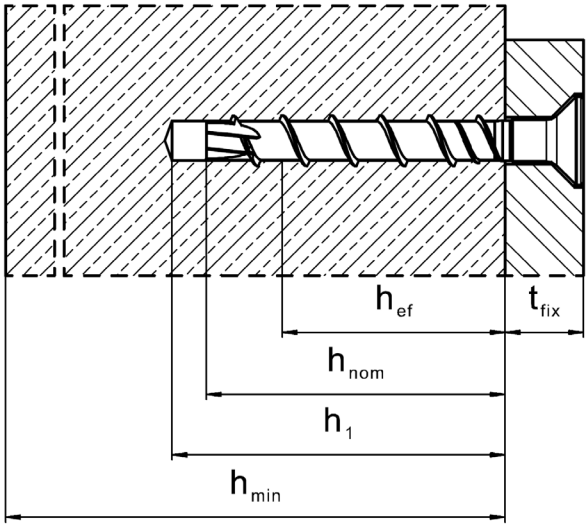
ANNEX A1
Product description
Installed condition without adjustment.

This annex applies to the product described in the main body of the UK Technical Assessment.

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)

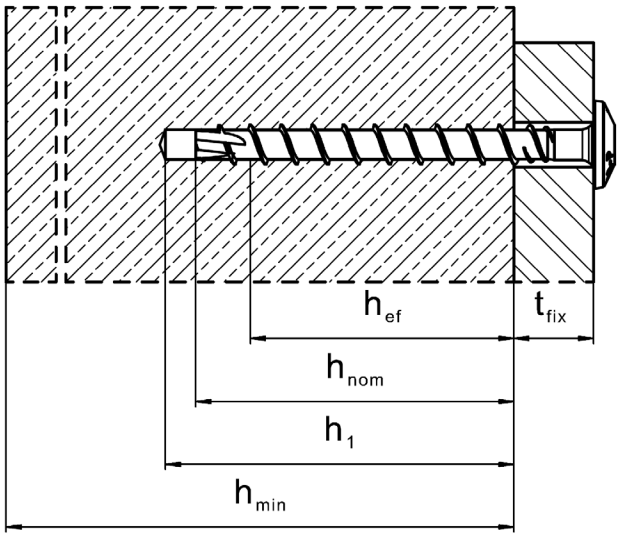


HUS3-C (Countersunk head configuration sizes 6, 8 and 10)

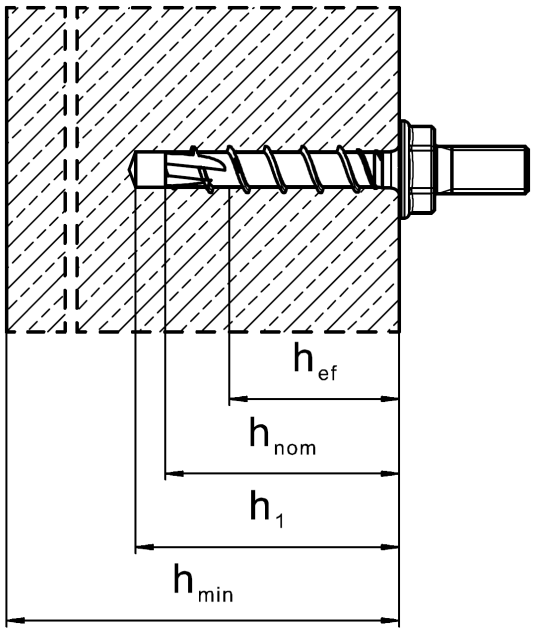
ANNEX A2
Product description
Installed condition without adjustment.

This annex applies to the product described in the main body of the UK Technical Assessment.

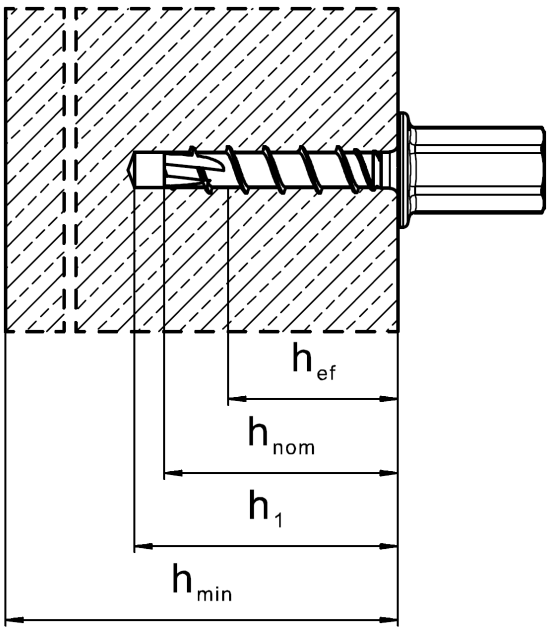
Installed condition without adjustment.



HUS3-P/PS/PL (Pan head configuration size 6)



HUS3-A (Size 6 with external thread configuration M6, M8, M10 or M12)

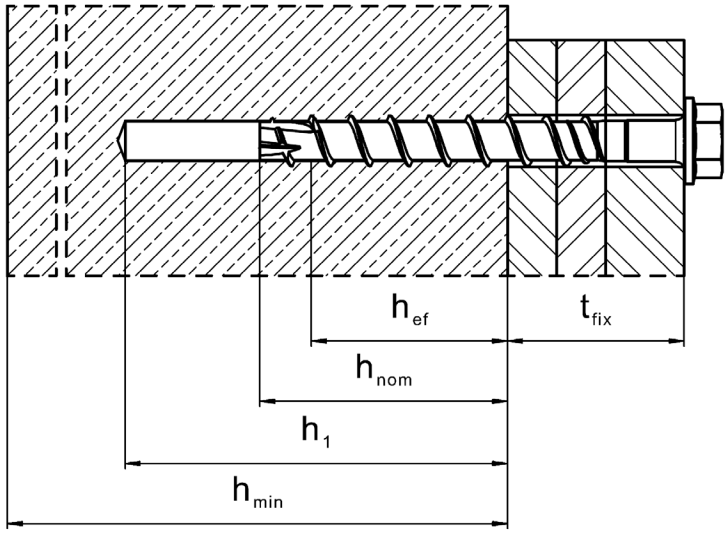


HUS3-I (Size 6 with internal thread configuration M8/M10)

ANNEX A3
Product description
Installed condition with adjustment.

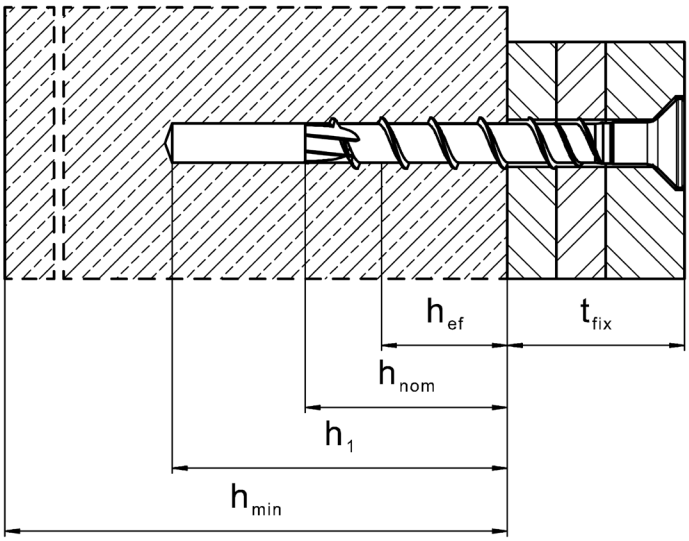
This annex applies to the product described in the main body of the UK Technical Assessment.

Installed condition with adjustment



HUS3-H (Hexagon head configuration sizes 8, 10 – h_{nom2}, h_{nom3})

HUS3-HF (Hexagon head configuration sizes 8 and 10 – h_{nom2}, h_{nom3})

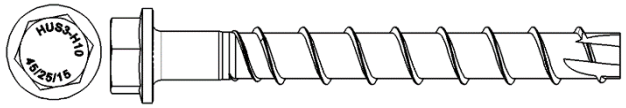
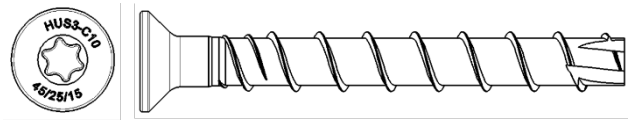
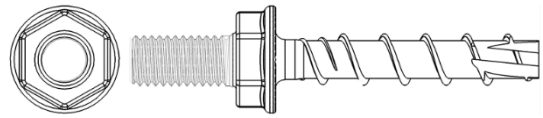
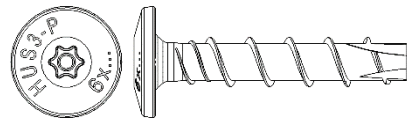
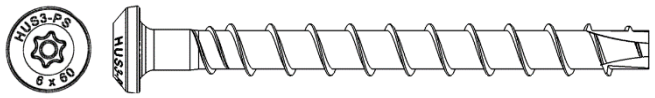
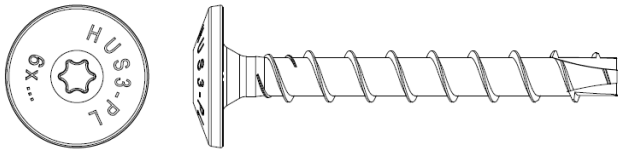
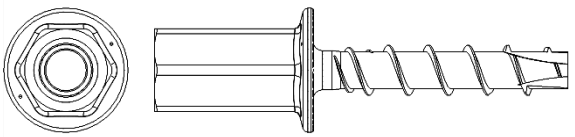
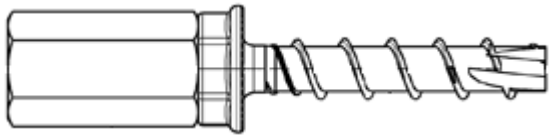


HUS3-C (Countersunk head configuration sizes 8 and 10 – h_{nom2}, h_{nom3})

ANNEX A4
Production description
Screw types

This annex applies to the product described in the main body of the UK Technical Assessment.

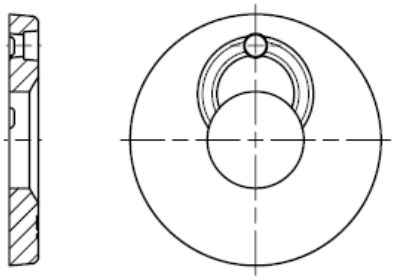
Table A1: Screw types

	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 M6, M8, M10 and M12, galvanized
	5) Hilti HUS3-P, size 6, pan head configuration, galvanized
	6) Hilti HUS3-PS, size 6, pan head (small) configuration, galvanized
	7) Hilti HUS3-PL, size 6, pan head (large) configuration, galvanized
	8) Hilti HUS3-I, size 6, internal thread M8 and M10, galvanized
	9) Hilti HUS3-I Flex, size 6, galvanized, with external thread - M8/16 preassembled with coupler M6 or M8, - M10/21 preassembled with coupler M10 or M12

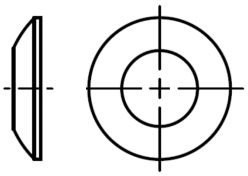
ANNEX A5
Production description
Components of filling set

This annex applies to the product described in the main body of the UK Technical Assessment.

Hilti filling set (for HUS3-H only)
Sealing washer



Spherical washer



Injection mortar Hilti HIT-HY 200-A
Foil pack 330 ml and 500 ml

Marking:
HILTI HIT
Production number and production line
Expiry date mm/yyyy

Product name: “Hilti HIT-HY 200-A”

Static mixer Hilti HIT-RE-M

ANNEX A6
Production description
Materials and fastener dimensions

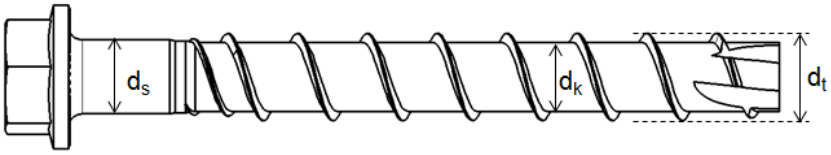
This annex applies to the product described in the main body of the UK Technical Assessment.

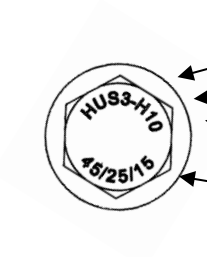
Table A2: Materials

Part	Designation	Material	
HUS3 screw anchor (all types in Table A1)	Size 6 all lengths	$f_{yk} \geq 745$ N·mm^{-2} , $f_{uk} \geq 930$ N·mm^{-2}	Carbon steel Rupture elongation $A_5 \leq 8\%$
	Size 8 all lengths	$f_{yk} \geq 695$ N·mm^{-2} , $f_{uk} \geq 810$ N·mm^{-2}	
	Size 10 all lengths	$f_{yk} \geq 690$ N·mm^{-2} , $f_{uk} \geq 805$ N·mm^{-2}	
	Size 14 all lengths	$f_{yk} \geq 630$ N·mm^{-2} , $f_{uk} \geq 730$ N·mm^{-2}	

Table A3: Fastener dimensions and marking.

Fastener size HUS3		**6**		**8**			**10**			**14**		
Type		**H, C, A, P, PS, PL, I, I-Flex**		**H, HF, C**			**H, HF, C**			**H, HF**		
Nominal embedment depth	[mm]	h_{nom1}	h_{nom2}	h_{nom1}	h_{nom2}	h_{nom3}	h_{nom1}	h_{nom2}	h_{nom3}	h_{nom1}	h_{nom2}	h_{nom3}
		40	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 Annexes B4 and B5)

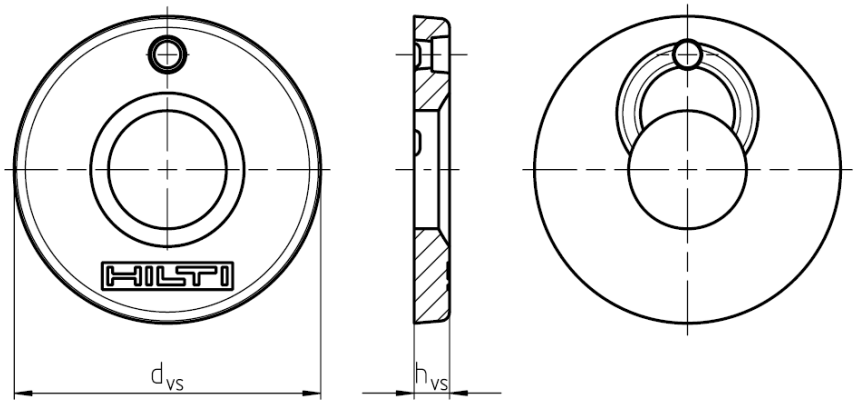
ANNEX A7
Production description
Filling washer dimensions

This annex applies to the product described in the main body of the UK Technical Assessment.

Table A4: Hilti filling washer dimensions

Fastener size	Hilti filling set size	Hilti filling washer	
		Diameter d_{vs} [mm]	Thickness h_{vs} [mm]
HUS3-H 8	M10	42	5
HUS3-H 10	M12	44	5
HUS3-H 14	M16	52	6

Hilti filling washer



ANNEX B1
Intended use.
Specifications

This annex applies to the product described in the main body of the UK Technical Assessment.

Specifications of intended use

Anchorages subject to:

- Static and quasi-static loadings: all sizes and all embedment depths.
- Seismic action for performance category C1:
  HUS3 size 6, standard and maximum embedment depth (h_{nom1}, h_{nom2}).
  HUS3-H and HUS3-HF sizes 8, 10 and 14, standard and maximum embedment depth (h_{nom2}, h_{nom3}).
  HUS3-C sizes 8 and 10, standard and maximum embedment depth (h_{nom2}, h_{nom3}).
- Seismic action for performance category C2:
  HUS3-H sizes 8, 10 and 14, maximum embedment depth (h_{nom3}).
  HUS3-C and HUS3-HF sizes 8 and 10, maximum embedment depth (h_{nom3}).
- Fire exposure: All sizes and all embedment depths.

Base materials:

- 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 206:2013+A1:2016.
- Uncracked or 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 fastener is indicated on the design drawings (e. g. position of the fastener relative to reinforcement or to supports, etc.).
- Anchorages under static or quasi-static actions are designed in accordance with:
  EN 1992-4:2018
- Anchorages under seismic actions (cracked concrete) are designed in accordance with:
  EN 1992-4:2018
- Anchorages should be positioned outside of critical regions (e.g. plastic hinges) of the concrete structure. Fastenings where shear loads act on fasteners with a lever arm, such as e.g.in stand-off installation or with a grout layer, are not covered.
- Anchorages under fire exposure are designed in accordance with: EN 1992-4:2018.
  In case of requirements to resistance to fire, local spalling of the concrete cover must be avoided.
- For the HUS3-PL 6, installed as described in Table B1 (Annex B3), the characteristic resistance to shear loading of a group of two or three screws must be limited to the characteristic value of one screw. The characteristic resistance to shear loading of a group of four or more screws must be limited to the characteristic value of two screws.

ANNEX B2
Intended use.
Specifications

This annex applies to the product described in the main body of the UK Technical Assessment.

Specifications of intended use

Installation:

- Hammer drilling: all sizes and all embedment depths.
- Hollow drill bit: only size 14.
- Fastener installation carried out by appropriately qualified personnel and under the supervision of the person responsible for technical matters of the site.
- In the case of an 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 must be supported on the fixture and is not damaged.
- Adjustability according to Annex B9 for:
  HUS3-H, HUS3-HF and HUS3-C size 8 (h_{nom2} = 60 mm and h_{nom3} = 70 mm)
  HUS3-H, HUS3-HF and HUS3-C size 10 (h_{nom2} = 75 mm and h_{nom3} = 85 mm)
- Installation with Hilti filling set (HUS3-H only) according to Annex B8.

ANNEX B3
Intended use.
Installation parameters

This annex applies to the product described in the main body of the UK Technical Assessment.

Table B1: Installation parameters HUS3 size 6

Fastener size HUS3			**6**											
Type			**H**	**C**	**A**	**P-PS**	**I I-Flex**	**PL**	**H**	**C**	**A**	**P-PS**	**I I-Flex**	**PL**
Nominal embedment depth	h_{nom}	[mm]	40						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					10	9					10
Wrench size (H, A, I -type)	SW	[mm]	13	-	13	-	13	-	13	-	13	-	13	-
Countersunk head diameter	d_h	[mm]	-	11.5	-	-	-	-	-	11.5	-	-	-	-
Torx size (C, P, PS, PL –type)	TX	-	-	30	-	30	-	30	-	30	-	30	-	30
Depth of drill hole in floor/ wall position	$h_1 \geq$	[mm]	50						65					
Depth of drill hole in ceiling position	$h_1 \geq$	[mm]	43						58					
Installation Torque	T_{inst}	[Nm]	20						25					
Setting tool (1) Strength class		≥ C20/25	Hilti SIW 14 A or Hilti SIW 22 A											

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

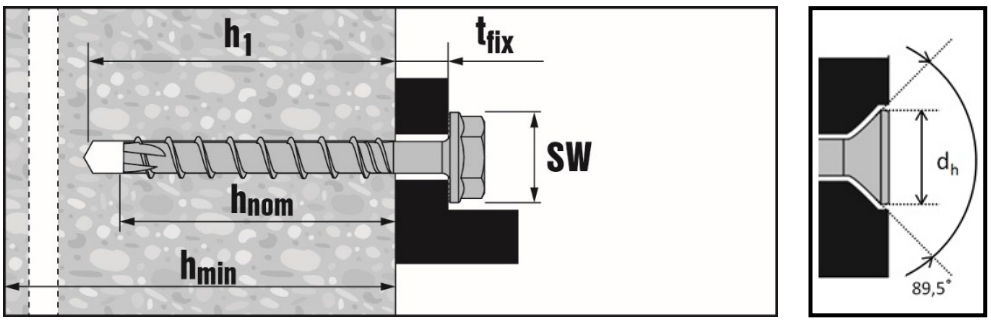
Table B2: Installation parameters HUS3 size 8, 10 and 14

Fastener size HUS3			**8**			**10**			**14**		
Type			**H, HF, C**			**H, HF, C**			**H, HF**		
			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	90	-	95	105	-		
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 equivalent power is possible.

ANNEX B4
Intended use.
Minimum concrete thickness and minimum edge distance and spacing

This annex applies to the product described in the main body of the UK Technical Assessment.



Installation parameters for HUS3-H and -C

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

Fastener size HUS3				**6**	
				h_{nom1}	h_{nom2}
Nominal embedmenth depth		h_{nom}	[mm]	40	55
Minumum thickness of concrete member		h_{min}	[mm]	80	100
Cracked and non-cracked concrete	Minimum spacing	s_{min}	[mm]	35	35
	Minimum edge distance	c_{min}	[mm]	35	35

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

Fastener 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]	50	50	50	50	50	50	60	60	60
				40 if c ≥ 50								
	Minimum edge distance	c_{min}	[mm]	40	40	40	50	50	50	60	60	60

ANNEX B5
Intended use.
Standard screw lengths and thickness of fixture

This annex applies to the product described in the main body of the UK Technical Assessment.

Table B5: Standard (1) screw lengths and maximum thickness of fixture for HUS3 size 6

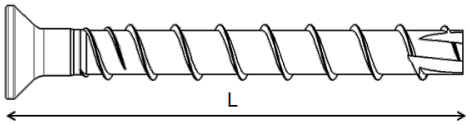
Fastener size	**6**											
	H	**C**	**A**	**I I-Flex**	**P**	**PS PL**	**H**	**C**	**A**	**I I-Flex**	**P**	**PS PL**
Nominal embedment depth [mm]	h_{nom1} 40						h_{nom2} 55					
	Thickness of fixture [mm]											
Length of screw [mm]	t_{fix1}	t_{fix1}	t_{fix1}	t_{fix1}	t_{fix1}	t_{fix1}	t_{fix2}	t_{fix2}	t_{fix2}	t_{fix2}	t_{fix2}	t_{fix2}
40	-	-	0	0	-	-	-	-	-	-	-	-
45	5	5	5	5	5	5	-	-	-	-	-	-
55	-	-	15	15	-	-	-	-	0	0	-	-
60	20	20	-	-	20	20	5	5	-	-	5	5
70	-	30	-	-	-	-	-	15	-	-	-	-
80	40	-	-	-	40	-	25	-	-	-	25	-
100	60	-	-	-	-	-	45	-	-	-	-	-
120	80	-	-	-	-	-	65	-	-	-	-	-
135	-	-	95	-	-	-	-	-	80	-	-	-
155	-	-	115	-	-	-	-	-	100	-	-	-
175	-	-	135	-	-	-	-	-	120	-	-	-
195	-	-	155	-	-	-	-	-	140	-	-	-

(1) Non-standard lengths, in the range 40 mm ≤ L ≤ 195 mm, are also in the scope of this UKTA.

Table B6: Standard (1) screw lengths and maximum thickness of fixture for HUS3-C size 8, 10

Fastener 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
	Thickness of fixture [mm]					
Length of screw [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

(1) Non-standard lengths, in the range 65 mm ≤ L ≤ 100 mm, are also in the scope of this UKTA.



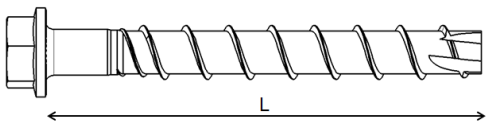
ANNEX B6
Intended use.
Standard screw lengths and thickness of fixture

This annex applies to the product described in the main body of the UK Technical Assessment.

Table B7: Standard [1] screw lengths and maximum thickness of fixture for HUS3-H, HUS3-HF

Fastener size	**8**			**10**			**14**		
Nominal embedment depth [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]								
Length of screw [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] Non-standard lengths, in the range 55 mm ≤ L ≤ 150 mm, are also in the scope of this UKTA.



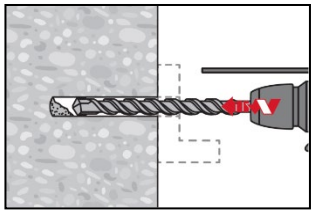
ANNEX B7
Intended use.
Installation instructions without adjustment

This annex applies to the product described in the main body of the UK Technical Assessment.

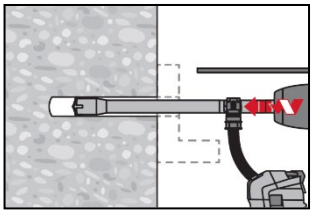
Installation instructions

Hole drilling

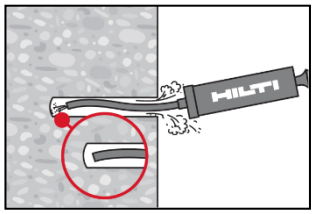
a) Hammer drilling (HD):
Size 6 to 14



b) Hammer drilling with Hilti hollow drill bit (HDB):
Size 14 only. After drilling, proceed to fastener setting



Drill hole cleaning



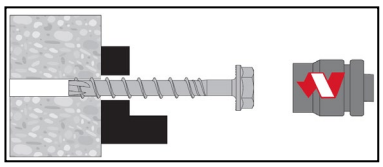
Clean the drill hole. For sizes 6 and 8, hole cleaning is not required when 3x ventilation (1) after drilling is executed and one of the following conditions is fulfilled:
- drilling is in the vertical upwards orientation; or
- drilling is in vertical downwards direction and the drilling depth is increased (2) by additional 3*d_0.

For sizes 10 and 14, hole cleaning is not required when 3x ventilation1) after drilling is executed and one of the following conditions is fulfilled:
- drilling is in the vertical upwards orientation; or
- drilling is in vertical downwards or horizontal direction and the drilling depth is increased (2) by additional 3*d_0; or
- Hilti hollow drill bit TE-CD is used for drilling.

(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 should be done with both revolution and hammer functions activated in the drilling machine. For more details read the relevant MPII.
(2) It should be verified that the thickness of the concrete member in which the fastener is installed observes the minimum distance between the drilling end and the opposite end of the member, fulfilling the relation $h > h_1 + \Delta h$ with Δh = maximum (2*d_0; 30 mm).

Fastener setting

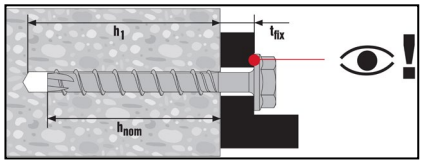
a) Setting by impact screw driver



b) Setting by torque wrench

Setting parameters listed in Tables B1 and B2

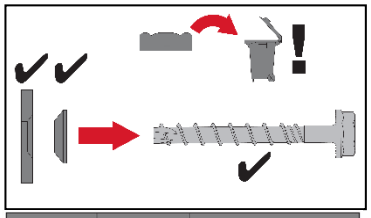
Setting check



ANNEX B8
Intended use.
Installation instructions with Hilti filling set
This annex applies to the product described in the main body of the UK Technical Assessment.

Fastener setting with Hilti filling set (HUS3-H only)

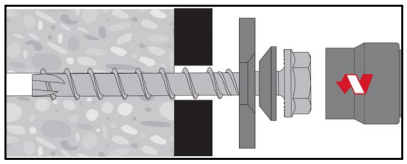
Installation of sealing washer



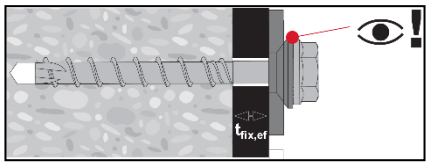
Size Seismic Set	Size HUS3	$t_{fix,\ effective}$ (mm)
M10	8	t_{fix} – 7 mm
M12	10	t_{fix} – 8 mm
M16	14	t_{fix} – 9 mm

The maximum fixture thickness t_{fix} is reduced by the overall thickness of the Hilti Filling Set after installation.

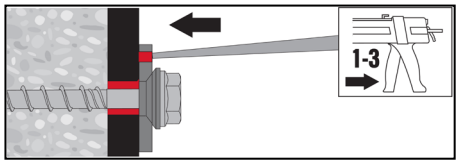
Setting by impact screw driver



Setting check



Injection of mortar



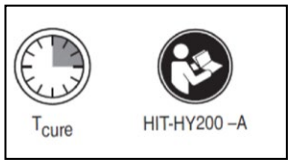


Table B8: Maximum working time and minimum curing time HY 200-A

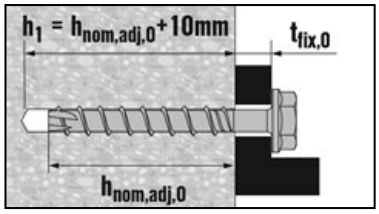
Temperature in the base material T	Maximum working time t_{work}	Minimum curing time t_{cure}
> 0 °C to 5 °C	25 min	2 hours
> 5 °C to 10 °C	15 min	75 min
> 10 °C to 20 °C	7 min	45 min
> 20 °C to 30 °C	4 min	30 min
> 30 °C to 40 °C	3 min	30 min

ANNEX B9
Intended use.
Installation instructions with adjustment

This annex applies to the product described in the main body of the UK Technical Assessment.

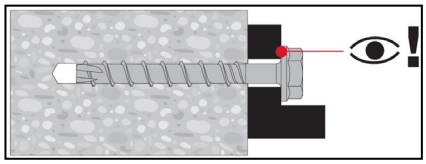
Fastener setting with adjustment

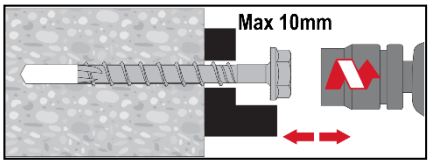
Drilling depth and fixture thickness



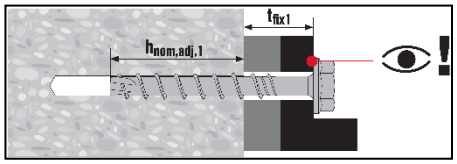
Adjusting process

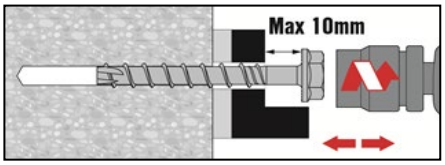
1st step



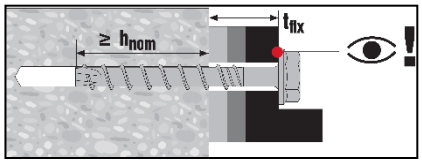


2nd step





Setting check



A screw can be adjusted a maximum of 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 than or equal to h_{nom2} or h_{nom3}.

ANNEX C1
Performances
Essential characteristics under static and quasi-static load in concrete

This annex applies to the product described in the main body of the UK Technical Assessment.

Table C1: Essential characteristics under static and quasi-static load in concrete for HUS3 size 6

Fastener size HUS3				**6**											
Type				**H**	**C**	**A**	**I I-Flex**	**P**	**PS PL**	**H**	**C**	**A**	**I I-Flex**	**P**	**PS PL**
Nominal embedment depth		h_{nom}	[mm]	h_{nom1} 40						h_{nom2} 55					
Steel failure for tension and shear load															
Characteristic resistance		$N_{Rk,s}$	[kN]	24	22	24			21	24	22	24			21
Partial factor		$\gamma_{Ms,N}$ (1)	[-]	1.4											
Characteristic resistance		$V^0_{Rk,s}$	[kN]	12.5											
Partial factor		$\gamma_{Ms,V}$ (1)	[-]	1.5											
Ductility factor		k_7	[-]	0.8											
Characteristic resistance		$M^0_{Rk,s}$	[Nm]	21											
Pull-out failure															
Characteristic resistance in non-cracked concrete C20/25		$N_{Rk,p}$	[kN]	7						9					7,5
Characteristic resistance in cracked concrete C20/25		$N_{Rk,p}$	[kN]	2.5						6					
Increasing factor for concrete ψ_c	C30/37		[-]	1.22											
	C40/50		[-]	1.41											
	C50/60		[-]	1.58											
Concrete cone and splitting failure															
Effective embedment depth		h_{ef}	[mm]	30						42					
Characteristic resistance to prevent splitting		$N^0_{Rk,sp}$	[kN]	7						9					7,5
Factor for	Cracked	$k_{cr,N}$	[-]	7.7											
	Non-cracked	$k_{ucr,N}$	[-]	11.0											
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]	60						63					
	Spacing	$s_{cr,sp}$	[mm]	120						126					
Robustness		γ_{inst}	[-]	1.2											
Concrete pry-out failure															
Pry-out factor		k_8	[-]	1.0						1.5					
Concrete edge failure															
Effective length of fastener		$l_f = h_{ef}$	[mm]	30						42					
Outside diameter of fastener		d_{nom}	[mm]	6											

(1) In absence of other national regulations.

ANNEX C2
Performances
Essential characteristics under static and quasi-static load in concrete

This annex applies to the product described in the main body of the UK Technical Assessment.

Table C2: Essential characteristics under static and quasi-static load in concrete for HUS3 size 8, 10, 14

Fastener 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 maximum thickness of adjustment layers		t_{adj}	[mm]	-	10	10	-	10	10	-	-	-
Maximum number of adjustments		n_a	[-]	-	2	2	-	2	2	-	-	-
Steel failure for tension load												
Characteristic resistance		$N_{Rk,s}$	[kN]	39.2			62.2			96.6		
Partial factor		$\gamma_{Ms,N}$ (1)	[-]	1.4								
Pull-out failure												
Characteristic resistance in non-cracked concrete C20/25		$N_{Rk,p}$	[kN]	9	12	16	12	20	32	20	30	44
Characteristic resistance in cracked concrete C20/25		$N_{Rk,p}$	[kN]	6	9	12	9	15	19	15	19	30
Increasing factor for concrete ψ_c	C30/37		[-]	1.22								
	C40/50		[-]	1.41								
	C50/60		[-]	1.58								
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
Characteristic resistance to prevent splitting		$N^0_{Rk,sp}$	[kN]	9	12	16	12	20	26	17	26	42
Factor for	Cracked	$k_{cr,N}$	[-]	7.7								
	Non-cracked	$k_{ucr,N}$	[-]	11.0								
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]	60	70	85	65	90	110	85	100	140
	Spacing	$s_{cr,sp}$	[mm]	120	140	170	130	180	220	170	200	280
Robustness		γ_{inst}	[-]	1.0								

(1) In absence of other national regulations.

ANNEX C3
Performances
Essential characteristics under static and quasi-static load in concrete

This annex applies to the product described in the main body of the UK Technical Assessment.

Table C2 continued

Fastener 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 maximum thickness of adjustment layers	t_{adj}	[mm]	-	10	10	-	10	10	-	-	-
Maximum number of adjustments	n_a	[-]	-	2	2	-	2	2	-	-	-
Steel failure for shear load											
Characteristic resistance	$V^0_{Rk,s}$	[kN]	19		22	30		34	55		62
Partial factor	$\gamma_{Ms,V}$ (1)	[-]	1.5								
Ductility factor	k_7	[-]	0.8								
Characteristic resistance	$M^0_{Rk,s}$	[Nm]	46			92			187		
Concrete pry-out failure											
Pry-out factor	k_8	[-]	1.0	2.0		1.0	2.0				
Concrete edge failure											
Effective length of fastener	$l_f = h_{ef}$	[mm]	40	46.4	54.9	41.6	58.6	67.1	49.3	66.3	91.8
Outside diameter of fastener	d_{nom}	[mm]	8			10			14		

(1) In absence of other national regulations.

ANNEX C4
Performances
Essentials characteristics for seismic performance category C1 in concrete

This annex applies to the product described in the main body of the UK Technical Assessment.

Table C3: Essential characteristics for seismic performance category C1 in concrete for HUS3 size 6

Fastener size HUS3				**6**									
Type				H	C	A	I I-Flex	P	PS PL	H	C	A	I I-Flex	P	PS PL
Nominal embedment depth		h_{nom}	[mm]	h_{nom1} 40						h_{nom2} 55					
Steel failure for tension and shear load															
Characteristic resistance		$N_{Rk,s,C1}$	[kN]	24	22	24			21	24	22	24			21
Partial factor		$\gamma_{Ms,N}$ (1)	[-]	1.4											
Characteristic resistance		$V_{Rk,s,C1}$	[kN]	5											
Partial factor		$\gamma_{Ms,V}$ (1)	[-]	1.5											
Pull-out failure															
Characteristic resistance in cracked concrete		$N_{Rk,p,C1}$	[kN]	2.5						4					
Concrete cone failure															
Effective embedment depth		h_{ef}	[mm]	30						42					
Concrete cone failure	Edge distance	$c_{cr,N}$	[mm]	1.5 h_{ef}											
	Spacing	$s_{cr,N}$	[mm]	3 h_{ef}											
Robustness		γ_{inst}	[-]	1.2											
Concrete pry-out failure															
Pry-out factor		k_8	[-]	1.0						1.5					
Concrete edge failure															
Effective length of fastener		$l_f = h_{ef}$	[mm]	30						42					
Outside diameter of fastener		d_{nom}	[mm]	6											

(1) In absence of other national regulations.

ANNEX C5
Performances
Essentials characteristics for seismic performance category C1 in concrete

This annex applies to the product described in the main body of the UK Technical Assessment.

Table C4: Essential characteristics for seismic performance category C1 in concrete for HUS3 size 8, 10, 14

Fastener size HUS3				**8**		**10**		**14**	
				h_{nom2}	h_{nom3}	h_{nom2}	h_{nom3}	h_{nom2}	h_{nom3}
Nominal embedment depth		h_{nom}	[mm]	60	70	75	85	85	115
Steel failure for tension and shear load									
Characteristic resistance		$N_{Rk,s,C1}$	[kN]	39.2		62,2		96,6	
Partial factor		$\gamma_{Ms,N}$ (1)	[-]	1.4					
Characteristic resistance		$V_{Rk,s,C1}$	[kN]	11.9		16.8	17.7	22.5	34.5
Partial factor		$\gamma_{Ms,V}$ (1)	[-]	1.5					
Pull-out failure									
Characteristic resistance in cracked concrete		$N_{Rk,p,C1}$	[kN]	9	12	15	19	19	30
Concrete cone failure									
Effective embedment depth		h_{ef}	[mm]	46.4	54.9	58.6	67.1	66.3	91.8
Concrete cone failure	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]	46.4	54.9	58.6	67.1	66.3	91.8
Outside diameter of fastener		d_{nom}	[mm]	8		10		14	

(1) In absence of other national regulations.

ANNEX C6
Performances
Essentials characteristics for seismic performance category C2 in concrete

This annex applies to the product described in the main body of the UK Technical Assessment.

Table C5: Essential characteristics for seismic performance category C2 in concrete

Fastener size HUS3				**8** h_{nom3}	**10** h_{nom3}	**14** h_{nom3}
Nominal embedment depth		h_{nom}	[mm]	70	85	115
Adjustment						
Total maximum thickness of adjustment layers		t_{adj}	[mm]	10	10	-
Maximum number of adjustments		n_a	[-]	2	2	-
Steel failure for tension load						
Characteristic resistance		$N_{Rk,s,C2}$	[kN]	39.2	62.2	96.6
Partial factor		$\gamma_{Ms,N}$ (1)	[-]	1.4		
Pull out failure						
Characteristic resistance in cracked concrete		$N_{Rk,p,C2}$	[kN]	3.2	9.4	17.7
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}		
	Spacing	$s_{cr,N}$	[mm]	3 h_{ef}		
Robustness		γ_{inst}	[-]	1.0		
Steel failure for shear load						
Installation with Hilti filling set (HUS3-H only)						
Partial factor		α_{gap}	[-]	1.0		
Characteristic resistance		$V_{Rk,s,C2}$	[kN]	14.7	25.6	46.5
Partial factor		$\gamma_{Ms,V}$ (1)	[-]	1.5		
Installation without Hilti filling set						
Partial factor		α_{gap}	[-]	0.5		
Characteristic resistance		$V_{Rk,s,C2}$	[kN]	10.8	17.7	34.4
Partial factor		$\gamma_{Ms,V}$ (1)	[-]	1.5		
Concrete pry-out failure						
Pry-out factor		k_8	[-]	2.0		
Concrete edge failure						
Effective length of fastener		$l_f = h_{ef}$	[mm]	54.9	67.1	91.8
Outside diameter of fastener		d_{nom}	[mm]	8	10	14

(1) In absence of other national regulations.

ANNEX C7
Performances
Essential characteristics under fire exposure in concrete

This annex applies to the product described in the main body of the UK Technical Assessment.

Table C6: Essential characteristics under fire exposure in concrete for HUS3 size 6

Fastener HUS3 **Type**				**6** **H, C, A, I, I-Flex, P, PS, PL**	
Nominal embedment depth		h_{nom}	[mm]	h_{nom1} 40	h_{nom2} 55
Steel failure for tension and shear load ($F_{Rk,s,fi} = N_{Rk,s,fi} = V_{Rk,s,fi}$)					
Characteristic resistance	R30	$N_{Rk,s,fi}$	[kN]	0.5	1.6
	R60	$N_{Rk,s,fi}$	[kN]	0.5	1.2
	R90	$N_{Rk,s,fi}$	[kN]	0.5	0.8
	R120	$N_{Rk,s,fi}$	[kN]	0.4	0.7
	R30	$M^0_{Rk,s,fi}$	[Nm]	0.4	1.4
	R60	$M^0_{Rk,s,fi}$	[Nm]	0.4	1.1
	R90	$M^0_{Rk,s,fi}$	[Nm]	0.4	0.7
	R120	$M^0_{Rk,s,fi}$	[Nm]	0.3	0.6
Pull-out failure					
Characteristic resistance	R30 R60 R90	$N_{Rk,p,fi}$	[kN]	0.6	1.5
	R120	$N_{Rk,p,fi}$	[kN]	0.5	1.2
Concrete cone failure					
Characteristic resistance	R30 R60 R90	$N^0_{Rk,c,fi}$	[kN]	0.8	1.8
	R120	$N^0_{Rk,c,fi}$	[kN]	0.7	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 should be ≥ 300 mm					
Fastener spacing					
R30 to R120		$s_{cr,fi}$	[mm]	2 $c_{cr,fi}$	
Concrete pry-out failure					
R30 to R120		k_8	[-]	1.0	1.5
The anchorage depth should be increased for wet concrete by at least 30 mm compared to the given value					

ANNEX C8
Performances
Essential characteristics under fire exposure in concrete

This annex applies to the product described in the main body of the UK Technical Assessment.

Table C7: Essential characteristics under fire exposure in concrete for HUS3-H and HUS3-HF

Fastener 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	$N_{Rk,s,fi}$	[kN]	3.2	3.5	3.8	6.1	6.2		10.4	10.6	
	R60	$N_{Rk,s,fi}$	[kN]	2.4	2.6	2.8	4.6	4.7		7.8	8.1	
	R90	$N_{Rk,s,fi}$	[kN]	1.6	1.6	1.9	3.1	3.2		5.3	5.5	
	R120	$N_{Rk,s,fi}$	[kN]	1.2	1.2	1.5	2.4	2.5		4.0	4.3	
	R30	$M^0_{Rk,s,fi}$	[Nm]	3.8	4.1	4.4	9.1	9.2		20.4	20.6	
	R60	$M^0_{Rk,s,fi}$	[Nm]	2.8	3.0	3.4	6.9	7.0		15.4	15.7	
	R90	$M^0_{Rk,s,fi}$	[Nm]	1.9	1.9	2.3	4.6	4.8		10.4	10.7	
	R120	$M^0_{Rk,s,fi}$	[Nm]	1.5	1.4	1.7	3.5	3.7		7.9	8.3	
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 should be ≥ 300 mm												
Fastener spacing												
R30 to R120		$s_{cr,fi}$	[mm]	$2\ c_{cr,fi}$								
Concrete pry-out failure												
R30 to R120		k_8	[-]	1.0	2.0		1.0	2.0				
The anchorage depth should be increased for wet concrete by at least 30 mm compared to the given value												

ANNEX C9
Performances
Essential characteristics under fire exposure in concrete

This annex applies to the product described in the main body of the UK Technical Assessment.

Table C8: Essential characteristics under fire exposure in concrete for HUS3-C

Fastener 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	$N_{Rk,s,fi}$	[kN]	0.5			1.2		
	R60	$N_{Rk,s,fi}$	[kN]	0.4			1.0		
	R90	$N_{Rk,s,fi}$	[kN]	0.3			0.8		
	R120	$N_{Rk,s,fi}$	[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 should be ≥ 300 mm									
Fastener spacing									
R30 to R120		$s_{cr,fi}$	[mm]	2 $c_{cr,fi}$					
Concrete pry-out failure									
R30 to R120		k_8	[-]	1.0	2.0		1.0	2.0	
The anchorage depth should be increased for wet concrete by at least 30 mm compared to the given value									

ANNEX C10
Performances
Displacement values in case of static and quasi-static loading

This annex applies to the product described in the main body of the UK Technical Assessment.

Table C9: Displacements under tension loads

Fastener size HUS3				**6**		
Type				**H, C, A, I, P, PS, PL**	**H, C, A, I**	**P, PS, PL**
Nominal embedment depth		h_{nom}	[mm]	h_{nom1} 40	h_{nom2} 55	
Cracked concrete C20/25 to C50/60	Tension Load	N	[kN]	1.0	2.4	
	Displacement	δ_{N0}	[mm]	0.1	0.1	
		$\delta_{N\infty}$	[mm]	0.6	0.6	
Non-cracked concrete C20/25 to C50/60	Tension Load	N	[kN]	2.8	3.6	3,0
	Displacement	δ_{N0}	[mm]	0.2	0.2	
		$\delta_{N\infty}$	[mm]	0.3	0.3	

Table C10: Displacements under tension loads

Fastener 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			[mm]	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
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			0.5		

Table C11: Displacements under shear loads

Fastener size HUS3				**6**		**8**			**10**			**14**		
				h_{nom1}	h_{nom2}	h_{nom1}	h_{nom2}	h_{nom3}	h_{nom1}	h_{nom2}	h_{nom3}	h_{nom1}	h_{nom2}	h_{nom3}
Nominal embedment depth			[mm]	40	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]	1.1	1.9	2.5	3.4	2.9	3.8	3.7	3.2	3.6	3.2	2.4
		$\delta_{V\infty}$	[mm]	2.0	2.8	3.7	5.1	4.4	5.7	5.5	4.9	5.4	6.9	3.5

ANNEX C11
Performances
Displacement values in case of seismic performance category C2

This annex applies to the product described in the main body of the UK Technical Assessment.

Table C12: Displacements under tension load for seismic performance category C2

Fastener size HUS3			**8** h_{nom3}	**10** h_{nom3}	**14** h_{nom3}
Nominal embedment depth			70	85	115
Displacement DLS	$\delta_{N,C2\ (DLS)}$	[mm]	0.35	0.57	1.43
Displacement ULS	$\delta_{N,C2\ (ULS)}$	[mm]	0.65	2.08	4.32

Table C13: Displacements under shear load for seismic performance category C2

Fastener size HUS3			**8** h_{nom3}	**10** h_{nom3}	**14** h_{nom3}
Nominal embedment depth			70	85	115
Installation with Hilti filling set (HUS3-H only)					
Displacement DLS	$\delta_{V,C2\ (DLS)}$	[mm]	1.81	1.80	2.52
Displacement ULS	$\delta_{V,C2\ (ULS)}$	[mm]	4.60	4.03	6.79
Installation without Hilti filling set					
Displacement DLS	$\delta_{V,C2\ (DLS)}$	[mm]	3.93	4.15	4.93
Displacement ULS	$\delta_{V,C2\ (ULS)}$	[mm]	5.55	6.15	9.14

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