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-11/0374 of 8 August 2016

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 stud anchor HSA
Product family to which the construction product belongs	Torque controlled expansion anchor for use in non-cracked concrete
Manufacturer	Hilti Aktiengesellschaft Business Unit Anchors 9494 Schaan FÜRSTENTUM LIECHTENSTEIN
Manufacturing plant	Hilti Werke
This European Technical Assessment contains	16 pages including 3 annexes
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 2: "Torque controlled expansion anchors", April 2013, used as European Assessment Document (EAD) according to Article 66 Paragraph 3 of Regulation (EU) No 305/2011.
This version replaces	ETA-11/0374 issued on 28 April 2016

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Specific Part

1 Technical description of the product

The Hilti stud anchor HSA is a torque controlled expansion anchor made of galvanised or stainless steel which is placed into a drilled hole and anchored by torque-controlled expansion.

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)

Essential characteristic	Performance
Characteristic resistance for static and quasi static action	See Annex C1 to C2
Displacements	See Annex C3

3.2 Safety in case of fire (BWR 2)

Essential characteristic	Performance
Reaction to fire	Anchorages satisfy requirements for Class A1
Resistance to fire	No performance assessed

3.3 Safety in use (BWR 4)

The essential characteristics regarding Safety in use are included under the 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 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 EAD

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

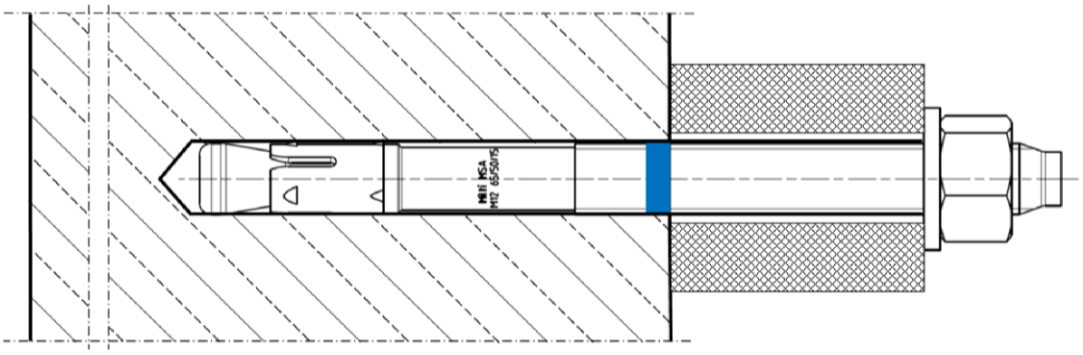
Issued in Berlin on 8 August 2016 by Deutsches Institut für Bautechnik

Uwe Bender
Head of Department

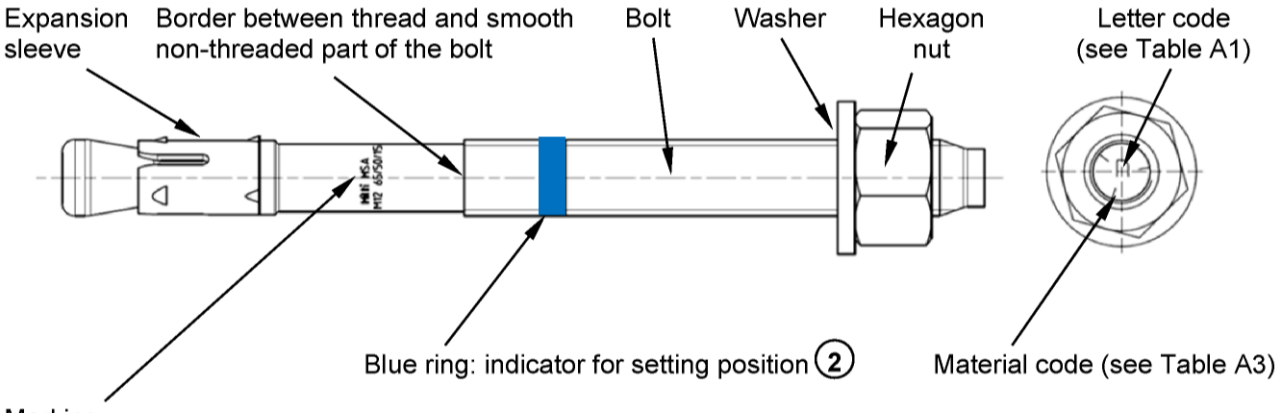
beglaubigt:
Lange

Deutsches Institut für Bautechnik DIBt

Installed condition



Product description: Hilti anchor HSA, HSA-BW, HSA-F, HSA-R2 and HSA-R



Hilti metal torque controlled expansion anchor HSA	Annex A1
Product description Installed condition, product marking and identification of anchor	

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Table A1: Letter code for identification of maximum fixture thickness[1)]

	M6	M8	M10	M12	M16	M20
	$t_{fix,1}/t_{fix,2}/t_{fix,3}$	$t_{fix,1}/t_{fix,2}/t_{fix,3}$	$t_{fix,1}/t_{fix,2}/t_{fix,3}$	$t_{fix,1}/t_{fix,2}/t_{fix,3}$	$t_{fix,1}/t_{fix,2}/t_{fix,3}$	$t_{fix,1}/t_{fix,2}/t_{fix,3}$
	[mm]/[mm]/[mm]	[mm]/[mm]/[mm]	[mm]/[mm]/[mm]	[mm]/[mm]/[mm]	[mm]/[mm]/[mm]	[mm]/[mm]/[mm]
z	**5/-/-**	**5/-/-**	**5/-/-**	**5/ -/-**	**5/-/-**	5/-/-
y	10/-/-	10/-/-	10/-/-	10/-/-	10/-/-	**10/-/-**
x	15/5/-	15/5/-	15/5/-	15/-/-	15/-/-	15/-/-
w	**20/10/-**	**20/10/-**	**20/10/-**	**20/5/-**	**20/5/-**	20/-/-
v	25/15/-	25/15/-	25/15	25/10/-	25/10/-	25/-/-
u	30/20/-	30/20/-	30/20/-	30/15/-	30/15/-	30/5/-
t	35/25/5	**35/25/-**	**35/25/-**	**35/20/-**	35/20/-	35/10/-
s	**40/30/10**	40/30/-	40/30/-	40/25/-	**40/25/-**	40/15/-
r	45/35/15	45/35/5	45/35/5	45/30/-	45/30/-	45/20/5
q	50/40/20	50/40/10	**50/40/10**	50/35/-	50/35/-	50/25/10
p	**55/45/25**	**55/45/15**	55/45/15	55/40/5	55/40/-	**55/30/15**
o	60/50/30	60/50/20	60/50/20	60/45/10	60/45/5	60/35/20
n	65/55/35	65/55/25	65/55/25	**65/50/15**	65/50/10	65/40/25
m	70/60/40	70/60/30	**70/60/30**	70/55/20	70/55/15	70/45/30
l	75/65/45	75/65/35	75/65/35	75/60/25	75/60/20	75/50/35
k	80/70/50	**80/70/40**	80/70/40	80/65/30	80/65/25	80/55/40
j	85/75/55	85/75/45	85/75/45	85/70/35	**85/70/30**	85/60/45
i	90/80/60	90/80/50	**90/80/50**	90/75/40	90/75/35	90/65/50
h	95/85/65	95/85/55	95/85/55	**95/80/45**	95/80/40	95/70/55
g	100/90/70	100/90/60	100/90/60	100/85/50	100/85/45	100/75/60
f	105/95/75	105/95/65	**105/95/65**	105/90/55	105/90/50	105/80/65
e	110/100/80	110/100/70	110/100/70	110/95/60	110/95/55	110/85/70
d	115/105/85	115/105/75	115/105/75	115/100/65	115/100/60	115/90/75
c	120/110/90	120/110/80	120/110/80	**125/110/75**	120/105/65	120/95/80
b	125/115/95	125/115/85	125/115/85	135/120/85	125/110/70	125/100/85
a	130/120/100	130/120/90	130/120/90	**145/130/95**	**135/120/80**	130/105/90
aa	-	-	-	155/140/105	145/130/90	-
ab	-	-	-	165/150/115	155/140/100	-
ac	-	-	-	175/160/125	165/150/110	-
ad	-	-	-	180/165/130	190/175/135	-
ae	-	-	-	230/215/180	240/225/185	-
af	-	-	-	280/265/230	290/275/235	-
ag	-	-	-	330/315/280	340/325/285	-

[1)] Anchor length in bold is standard item. For selection of other anchor lengths, check availability of the items.

Hilti metal torque controlled expansion anchor HSA

Product description
Letter code

Annex A2

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Table A2: Material code for identification of different materials

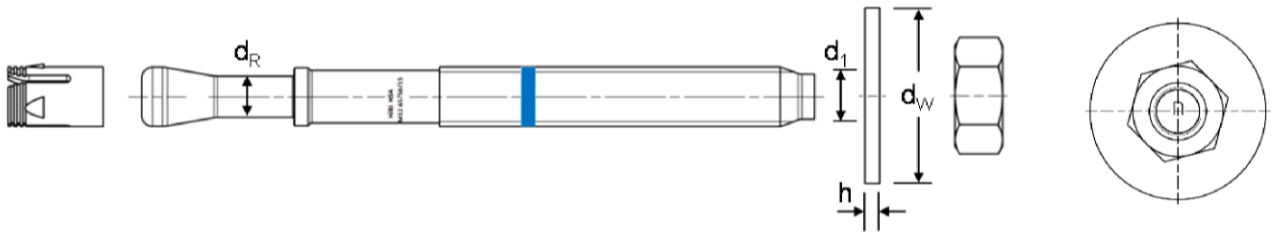
	HSA, HSA-BW, HSA-F	HSA-R2	HSA-R
Material code	 Letter code without mark	 Letter code with two marks	 Letter code with three marks

Table A3: Dimensions of Hilti anchor HSA, HSA-BW, HSA-F, HSA-R2 and HSA-R

			M6	M8	M10	M12	M16	M20
Min. inner diameter of washer	d_1	[mm]	6,4	8,4	10,5	13	17	21
Min. outer diameter of washer	d_W	[mm]	12	16	20	24	30	37
Min. thickness of washer	h	[mm]	1,6	1,6	2	2,5	3	3

Figure A1: Hilti anchor HSA, HSA-F, HSA-R2, HSA-R

Figure A2: Hilti anchor HSA-BW



Hilti metal torque controlled expansion anchor HSA

Product description
Material code and dimensions

Annex A3

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Specifications of intended use

Anchorages subject to:

- Static and quasi static loading.

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.
- Non-cracked concrete.

Use conditions (Environmental conditions):

- HSA, HSA-BW, HSA-F, HSA-R2, HSA-R:
  Structures subject to dry internal conditions.
- HSA-R (stainless steel A4):
  Structures subject to external atmospheric exposure (including industrial and marine environment) and to permanently damp internal conditions, if no particular aggressive conditions exist.
  Note: Particular aggressive conditions are e.g. permanent, alternating immersion in seawater or the splash zone of seawater, chloride atmosphere of indoor swimming pools or atmosphere with extreme chemical pollution (e. g. in desulphurization plants or road tunnels where de-icing products are used).

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 loading are designed in accordance with:
  ETAG 001, 04/2013, Annex C, design method A or
  CEN/TS 1992-4:2009.

Installation:

- Anchor installation carried out by appropriately qualified personnel and under the supervision of the person responsible for technical matters of the site.
- The anchor may only be set once.

Hilti metal torque controlled expansion anchor HSA	Annex B1
Intended use Specifications	

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Table B1: Drilling technique

Size	M6	M8	M10	M12	M16	M20
Hammer drilling (HD)	✓	✓	✓	✓	✓	✓
Hammer drilling with Hilti hollow drill bit TE-CD, TE-YD drilling system (HDB) 	-	-	-	✓	✓	✓
Diamond core drilling (DD) with diamond coring system DD 30-W and diamond core bit DD-C ... TS, DD-C ... TL 	-	-	✓	✓	✓	✓

Table B2: Drillhole cleaning

Manual cleaning (MC): Hilti hand pump for blowing out drillholes.	
Automatic cleaning (AC): Cleaning is performed during drilling with Hilti TE-CD and TE-YD drilling system including vacuum cleaner.	

Table B3: Setting alternatives

Size	M6	M8	M10	M12	M16	M20
Hammer setting	✓	✓	✓	✓	✓	✓
Machine setting (impact screw driver with setting tool)	-	✓	✓	✓	✓	-

Table B4: Methods for application of torque moment

Size		M6	M8	M10	M12	M16	M20
Torque wrench 		✓	✓	✓	✓	✓	✓
Setting tool S-TB HSA ... 		-	✓	✓	✓	✓	-
Impact screw driver Hilti SIW ...[1]		-	14-A / 22-A			22T-A	-
Speed	HSA, HSA-BW, HSA-F	-	1	1	3	-[2]	
	HSA-R2, HSA-R	-	3				-
Setting time	t_{set} [sec.]	-	4				-

[1] See Table B5 for battery state of charge depending on the ambient temperature.
[2] Impact screw driver operates with fixed speed.

Table B5: Battery state of charge of impact screw driver

Ambient temperature		≤ +5 °C	+5 to +10 °C	≥ +10 °C
Battery state of charge	low	-	-	-
	middle	-	-	✓
	high	-	✓	✓

Hilti metal torque controlled expansion anchor HSA

Intended use
Installation methods

Annex B2

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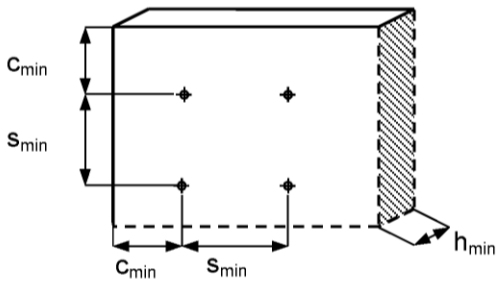
Table B6: Installation parameters

Size			M6			M8			M10			M12			M16			M20		
Nominal diameter of drill bit	d_0	[mm]	6			8			10			12			16			20		
Cutting diameter of drill bit	d_{cut}	[mm]	6,4			8,45			10,45			12,5			16,5			20,55		
Diameter of clearance hole in the fixture	d_f	[mm]	7			9			12			14			18			22		
Width across flats	S_w	[mm]	10			13			17			19			24			30		
Setting position			(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
Min. thickness of concrete member	h_{min}	[mm]	100		120	100		120	100	120	160	100	140	180	140	160	180	160	220	
Nominal anchorage depth	h_{nom}	[mm]	37	47	67	39	49	79	50	60	90	64	79	114	77	92	132	90	115	130
Effective anchorage depth	h_{ef}	[mm]	30	40	60	30	40	70	40	50	80	50	65	100	65	80	120	75	100	115
Min. drill hole depth (HD, HDB)	h_1	[mm]	42	52	72	44	54	84	55	65	95	72	87	122	85	100	140	98	123	138
Min. drill hole depth (DD)	h_1	[mm]	-			-			58	68	98	72	87	122	85	100	140	98	123	138
Standard installation torque moment																				
Installation torque moment	T_{inst}	[Nm]	5			15[1)]			25[1)]			50[1)]			80[1)]			200		
Min. spacing	s_{min}	[mm]	35			35			50			70			90			195	175	
Min. edge distance	c_{min}	[mm]	35			40	35		50	40		70	65	55	80	75	70	130	120	
Max. installation torque moment																				
Max. installation torque moment	T_{max}	[Nm]	-			20			35			80			150			250		
Min. spacing	s_{min}	[mm]	-			35			40			50			80			120		
Min. edge distance	c_{min}	[mm]	-			100			150			190			200			225		

[1)] Alternatively, the anchor can be tightened with an impact screw driver in combination with a setting tool with the required setting time (see Annex B2).



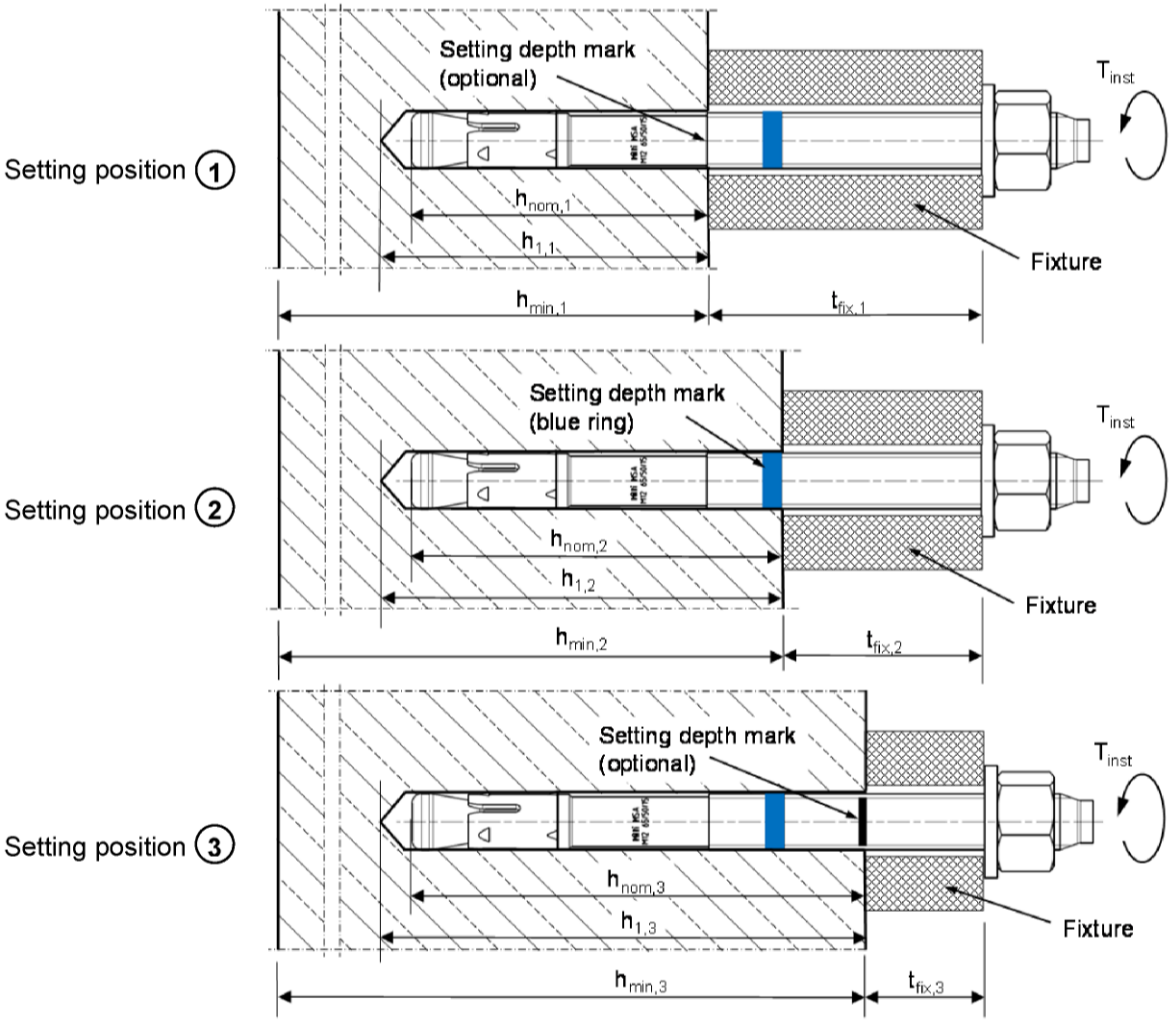
Hilti metal torque controlled expansion anchor HSA

Intended use
Installation parameters

Annex B3

Deutsches Institut für Bautechnik DIBt

Figure B1: Constant anchor length with various fixture thicknesses t_{fix} and corresponding setting position



Hilti metal torque controlled expansion anchor HSA	Annex B4
Intended use Installation parameters	

Figure B2: Various anchor lengths for different setting positions and corresponding fixture thickness t_{fix}

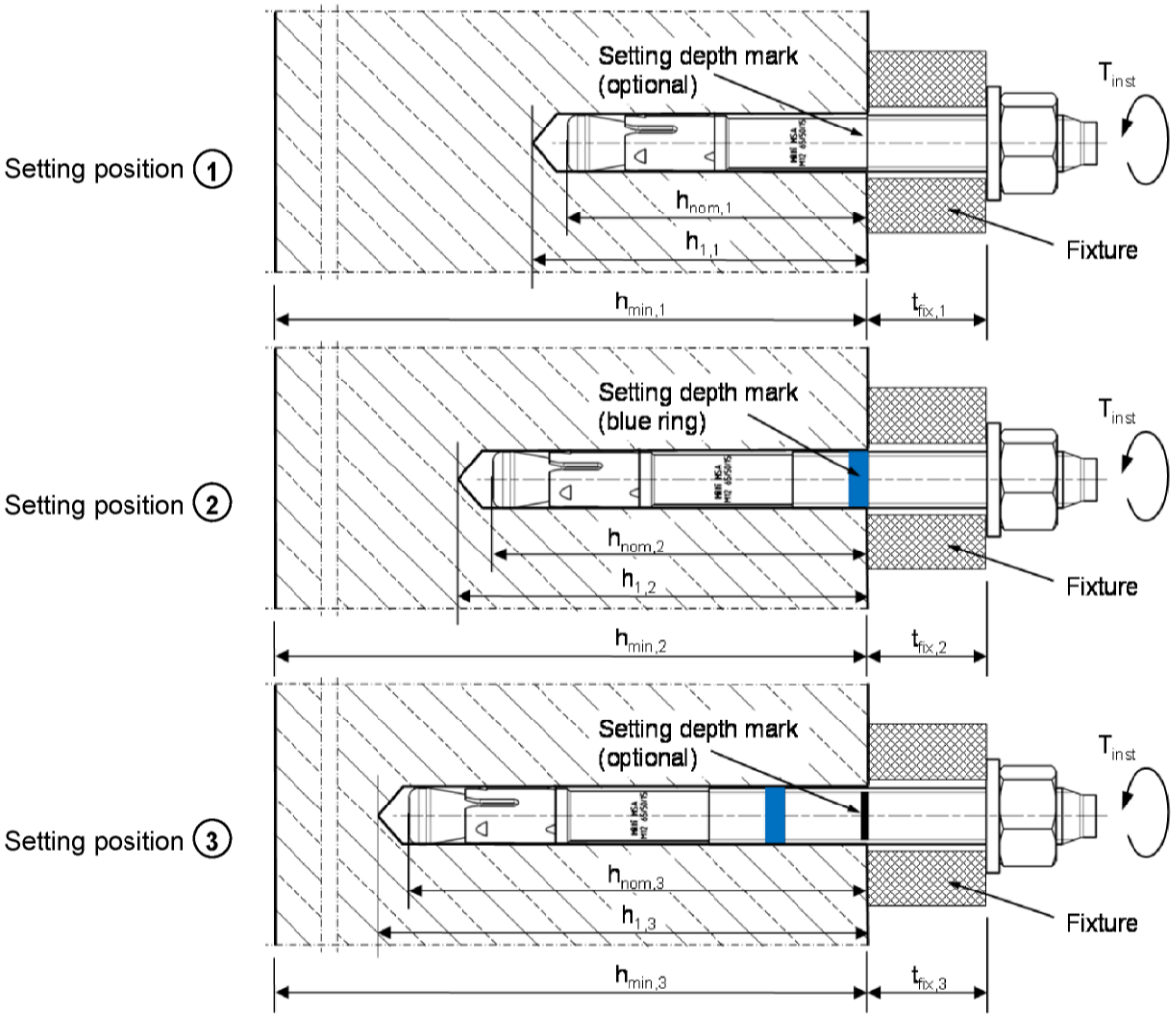


Table B7: Checking setting position

Setting position	Prior insertion method	Push-through insertion method
(1)	$h_{nom,1}$ is reached when the non-threaded part of the bolt is completely below the concrete surface. For anchor HSA with letter code "aa" to "ag" (see Table A1) $h_{nom,1}$ has to be measured and marked by the installer.	$h_{nom,1}$, $h_{nom,2}$ or $h_{nom,3}$ is reached when the present thickness of the fixture t_{fix} and the maximum thickness of the fixture $t_{fix,1}/t_{fix,2}/t_{fix,3}$ given by the anchor HSA (see Table A1) is identical. If the present thickness of the fixture t_{fix} is smaller than the maximum thickness of the fixture $t_{fix,1}/t_{fix,2}/t_{fix,3}$ given by the anchor HSA • position of washer and hexagon nut has to be adjusted or • drill hole depth h_1 has to be increased.
(2)	$h_{nom,2}$ is reached when the blue ring is completely below the concrete surface.	
(3)	$h_{nom,3}$ has to be measured and marked by the installer.	

Hilti metal torque controlled expansion anchor HSA	**Annex B5**
Intended use Installation parameters	

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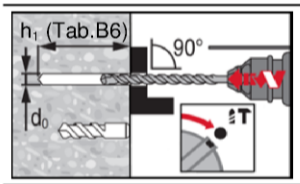
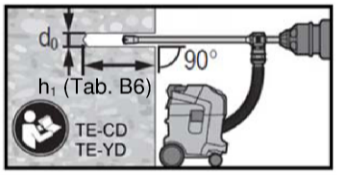
Installation instruction

Hole drilling

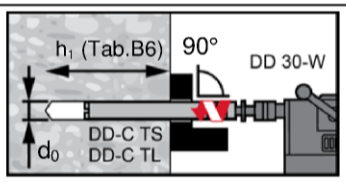
a) Hammer drilling (HD): M6 to M20



b) Hammer drilling with Hilti hollow drill bit (HDB): M12 to M20

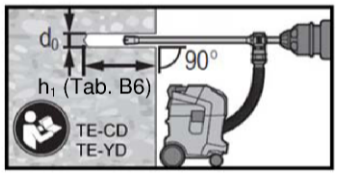


c) Diamond drilling (DD): M10 to M20



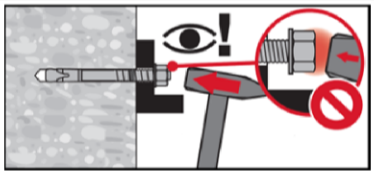
a) Manual cleaning (MC): M6 to M20

b) Automatic cleaning (AC): M12 to M20

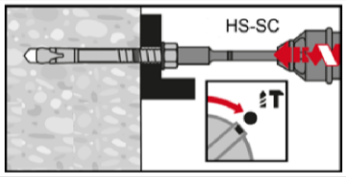


Anchor setting

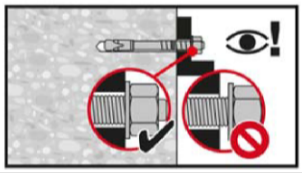
a) Hammer setting: M6 to M20



b) Machine setting (impact screw driver with setting tool): M8 to M16

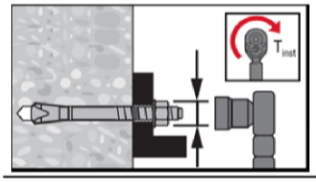


Check setting (see also Table B7)

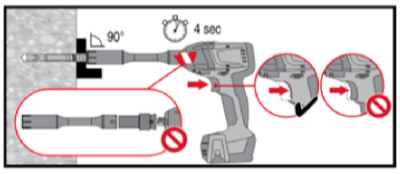


Anchor torqueing

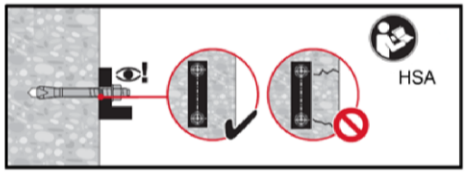
a) Torque wrench: M6 to M20



b) Impact screw driver with setting tool: M8 to M16



Check installation



Hilti metal torque controlled expansion anchor HSA	**Annex B6**
Intended use Installation instructions	

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Table C1: Characteristic resistance under tension load in non-cracked concrete

Size			**M6**			**M8**			**M10**			**M12**			**M16**			**M20**		
Setting position			①	②	③	①	②	③	①	②	③	①	②	③	①	②	③	①	②	③
Effective anchorage depth	h_{ef}	[mm]	30[1]	40	60	30[1]	40	70	40	50	80	50	65	100	65	80	120	75	100	115
Steel failure																				
Partial safety factor	γ_{Ms}[2]	[-]	1,4																	
HSA, HSA-BW																				
Characteristic resistance	$N_{Rk,s}$	[kN]	9,0			16,5			28,0			41,4			82,6			124		
HSA-F																				
Characteristic resistance	$N_{Rk,s}$	[kN]	9,5			15,9			27,0			40,4			80,1			-		
HSA-R2, HSA-R																				
Characteristic resistance	$N_{Rk,s}$	[kN]	12,2			18,3			35,6			44,6			90,5			97,6		
Pullout failure																				
Installation safety factor	$\gamma_2 = \gamma_{inst}$	[-]	1,00																	
Characteristic resistance	$N_{Rk,p}$	[kN]	6	7,5	9	-[3]	-[3]	16	-[3]	-[3]	25	-[3]	-[3]	35	-[3]	-[3]	50	-[3]	-[3]	-[3]
Increasing factor ψ_c	C20/25	[-]	1,00																	
	C30/37	[-]	1,22																	
	C40/50	[-]	1,41																	
	C50/60	[-]	1,55																	
Concrete cone and splitting failure																				
Installation safety factor	$\gamma_2 = \gamma_{inst}$	[-]	1,00																	
Factor	k_{ucr}[4]	[-]	10,1																	
Spacing	$s_{cr,N}$	[mm]	$3 \cdot h_{ef}$																	
	$s_{cr,sp}$	[mm]	100	120	130	130	180	200	190	210	290	200	250	310	230	280	380	260	370	400
Edge distance	$c_{cr,N}$	[mm]	$1,5 \cdot h_{ef}$																	
	$c_{cr,sp}$	[mm]	50	60	65	65	90	100	95	105	145	100	125	155	115	140	190	130	185	200

[1] Use is restricted to anchoring of statically indeterminate structural components.
[2] In absence of other national regulations.
[3] Pull-out failure is not decisive for design.
[4] For design according to CEN/TS 1992-4:2009.

Hilti metal torque controlled expansion anchor HSA

Performance
Characteristic resistance under tension load in non-cracked concrete
Design according to ETAG 001, 04/2013 or CEN/TS 1992-4:2009

Annex C1

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Table C2: Characteristic resistance under shear load in non-cracked concrete

Size			**M6**			**M8**			**M10**			**M12**			**M16**			**M20**		
Setting position			①	②	③	①	②	③	①	②	③	①	②	③	①	②	③	①	②	③
Effective anchorage depth	h_{ef}	[mm]	30[1]	40	60	30[1]	40	70	40	50	80	50	65	100	65	80	120	75	100	115
Steel failure without lever arm																				
Partial safety factor	γ_{Ms}[2]	[-]	1,25																	
HSA, HSA-BW																				
Characteristic resistance	$V_{Rk,s}$	[kN]	6,5			10,6			18,9			29,5			51,0			85,8		
HSA-F																				
Characteristic resistance	$V_{Rk,s}$	[kN]	6,5			10,6			18,9			29,5			51,0			-		
HSA-R2, HSA-R																				
Characteristic resistance	$V_{Rk,s}$	[kN]	7,2			12,3			22,6			29,3			56,5			91,9		
Steel failure with lever arm																				
Partial safety factor	γ_{Ms}[2]	[-]	1,25																	
HSA, HSA-BW																				
Characteristic resistance	$M^0_{Rk,s}$	[Nm]	9,9			21,7			48,6			91,7			216			454		
HSA-F																				
Characteristic resistance	$M^0_{Rk,s}$	[Nm]	9,9			21,7			48,6			91,7			216			-		
HSA-R2, HSA-R																				
Characteristic resistance	$M^0_{Rk,s}$	[Nm]	9,9			21,0			48,6			76,0			200			406		
Concrete pryout failure																				
Factor	$k^{3)} = k_3$[4]	[-]	1		2	1	1,5	2	2,4			2			2,9			2	3,5	
Concrete edge failure																				
Effective length of anchor	l_f	[mm]	30	40	60	30	40	70	40	50	80	50	65	100	65	80	120	75	100	115
Effective outside diameter of anchor	d_{nom}	[mm]	6			8			10			12			16			20		

[1] Use is restricted to anchoring of statically indeterminate structural components.
[2] In absence of other national regulations.
[3] For design according to ETAG 001, 04/2013, Annex C, chapter 5.2.3.3, equation (5.6).
[4] For design according to CEN/TS 1992-4:2009, chapter 6.2.2.3, equation (16).

Hilti metal torque controlled expansion anchor HSA

Performance
Characteristic resistance under shear load in non-cracked concrete
Design according to ETAG 001, 04/2013 or CEN/TS 1992-4:2009

Annex C2

Deutsches Institut für Bautechnik DIBt

Table C3: Displacements under tension and shear loads in non-cracked concrete

Size			**M6**			**M8**			**M10**			**M12**			**M16**			**M20**		
Setting position			①	②	③	①	②	③	①	②	③	①	②	③	①	②	③	①	②	③
Effective anchorage depth	h_{ef}	[mm]	30	40	60	30	40	70	40	50	80	50	65	100	65	80	120	75	100	115
Displacements under tension loads																				
Tension force	N	[kN]	2,9	3,6	4,3	4,0	6,1	7,6	6,1	8,5	11,9	8,5	12,6	16,7	12,6	17,2	23,8	16,6	25,1	30,8
Corresponding displacement	δ_{N0}	[mm]	0,2	0,6	1,0	0,2	1,2	1,8	0,4	1,1	2,0	0,3	1,4	2,3	0,4	1,3	2,1	0,1	0,8	1,9
	$\delta_{N\infty}$	[mm]	0,6	1,0	1,4	0,6	1,6	2,2	0,8	1,5	2,4	0,7	1,8	2,7	0,8	1,7	2,5	0,5	1,2	2,3
Displacements under shear loads																				
Shear force	V	[kN]	3,7			6,1			10,8			16,7			29,1			49,0		
Corresponding displacement	δ_{N0}	[mm]	1,6			1,9			2,0			2,1			2,2			2,3		
	$\delta_{N\infty}$	[mm]	2,4			2,9			3,0			3,2			3,3			3,5		

Hilti metal torque controlled expansion anchor HSA

Performance
Displacement under tension and shear loads in non-cracked concrete

Annex C3