

Approval body for construction products
and types of construction

Bautechnisches Prüfamt

An institution established by the Federal and
Laender Governments



European Technical Assessment

ETA-11/0374
of 28 August 2017

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 metal expansion anchor HSA

Product family
to which the construction product belongs

Mechanical fastener for use in uncracked concrete

Manufacturer

Hilti Aktiengesellschaft
Business Unit Anchors
9494 Schaan
FÜRSTENTUM LIECHTENSTEIN

Manufacturing plant

Hilti Werke

This European Technical Assessment
contains

17 pages including 3 annexes

This European Technical Assessment is
issued in accordance with Regulation (EU)
No 305/2011, on the basis of

EAD 330232-00-0601

This version replaces

ETA-11/0374 issued on 8 August 2016

European Technical Assessment

ETA-11/0374

English translation prepared by DIBt

Page 2 of 17 | 28 August 2017

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Specific Part

1 Technical description of the product

The Hilti metal expansion anchor HSA is a torque controlled expansion fastener 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, displacements	See Annex C1 to C3

3.2 Safety in case of fire (BWR 2)

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

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

In accordance with the European Assessment Document EAD 330232-00-0601 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 EAD

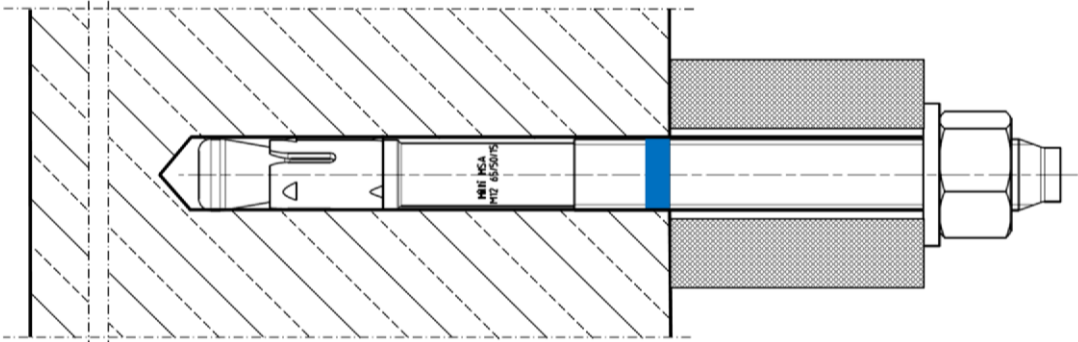
Technical details necessary for the implementation of the AVCP system are laid down in the control plan deposited with Deutsches Institut für Bautechnik.

Issued in Berlin on 28 August 2017 by Deutsches Institut für Bautechnik

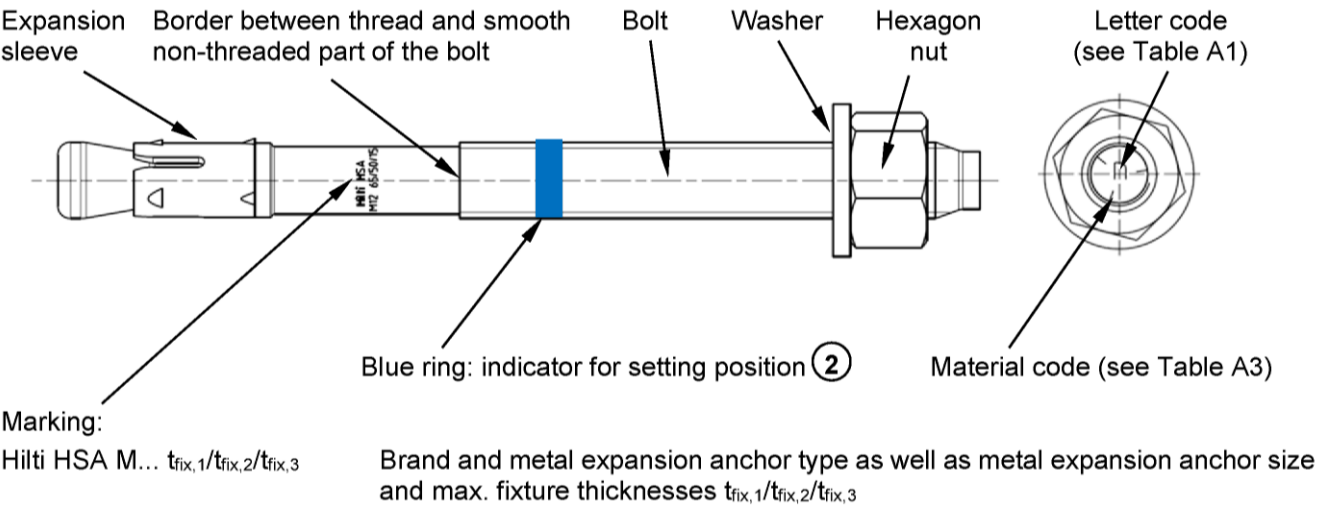
Dr.-Ing. Lars Eckfeldt
p. p. Head of Department

beglaubigt:
Lange

Installed condition



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



Hilti metal expansion anchor HSA

Product description
Installed condition, product marking and identification of metal expansion anchor

Annex A1

Table A1: Letter code for identification of maximum fixture thickness¹⁾

Size	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]
<u>z</u>	5/-/-	5/-/-	5/-/-	5/-/-	5/-/-	5/-/-
<u>y</u>	10/-/-	10/-/-	10/-/-	10/-/-	10/-/-	10/-/-
<u>x</u>	15/5/-	15/5/-	15/5/-	15/-/-	15/-/-	15/-/-
<u>w</u>	20/10/-	20/10/-	20/10/-	20/5/-	20/5/-	20/-/-
<u>v</u>	25/15/-	25/15/-	25/15	25/10/-	25/10/-	25/-/-
<u>u</u>	30/20/-	30/20/-	30/20/-	30/15/-	30/15/-	30/5/-
<u>t</u>	35/25/5	35/25/-	35/25/-	35/20/-	35/20/-	35/10/-
<u>s</u>	40/30/10	40/30/-	40/30/-	40/25/-	40/25/-	40/15/-
<u>r</u>	45/35/15	45/35/5	45/35/5	45/30/-	45/30/-	45/20/5
<u>q</u>	50/40/20	50/40/10	50/40/10	50/35/-	50/35/-	50/25/10
<u>p</u>	55/45/25	55/45/15	55/45/15	55/40/5	55/40/-	55/30/15
<u>o</u>	60/50/30	60/50/20	60/50/20	60/45/10	60/45/5	60/35/20
<u>n</u>	65/55/35	65/55/25	65/55/25	65/50/15	65/50/10	65/40/25
<u>m</u>	70/60/40	70/60/30	70/60/30	70/55/20	70/55/15	70/45/30
<u>l</u>	75/65/45	75/65/35	75/65/35	75/60/25	75/60/20	75/50/35
<u>k</u>	80/70/50	80/70/40	80/70/40	80/65/30	80/65/25	80/55/40
<u>j</u>	85/75/55	85/75/45	85/75/45	85/70/35	85/70/30	85/60/45
<u>i</u>	90/80/60	90/80/50	90/80/50	90/75/40	90/75/35	90/65/50
<u>h</u>	95/85/65	95/85/55	95/85/55	95/80/45	95/80/40	95/70/55
<u>g</u>	100/90/70	100/90/60	100/90/60	100/85/50	100/85/45	100/75/60
<u>f</u>	105/95/75	105/95/65	105/95/65	105/90/55	105/90/50	105/80/65
<u>e</u>	110/100/80	110/100/70	110/100/70	110/95/60	110/95/55	110/85/70
<u>d</u>	115/105/85	115/105/75	115/105/75	115/100/65	115/100/60	115/90/75
<u>c</u>	120/110/90	120/110/80	120/110/80	125/110/75	120/105/65	120/95/80
<u>b</u>	125/115/95	125/115/85	125/115/85	135/120/85	125/110/70	125/100/85
<u>a</u>	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 expansion anchor HSA



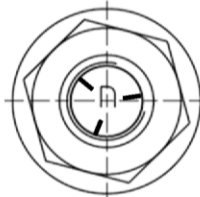
Product description
Letter code

Annex A2

Table A2: Materials

Designation	Material
HSA, HSA-BW	
Expansion sleeve	M6: Stainless steel A2 M8 – M20: Carbon steel, galvanized
Bolt	Carbon steel, galvanized, rupture elongation ($l_0 = 5d$) > 8 %
Washer	Carbon steel, galvanized
Hexagon nut	Carbon steel, galvanized
HSA-F	
Expansion sleeve	Stainless steel A2
Bolt	Hot-dip galvanized, rupture elongation ($l_0 = 5d$) > 8%
Washer	Hot-dip galvanized
Hexagon nut	Hot-dip galvanized
HSA-R2	
Expansion sleeve	Stainless steel A2
Bolt	Stainless steel A2, coated, rupture elongation ($l_0 = 5d$) > 8%
Washer	Stainless steel A2
Hexagon nut	Stainless steel A2, coated
HSA-R	
Expansion sleeve	Stainless steel A2
Bolt	Stainless steel A4, coated, rupture elongation ($l_0 = 5d$) > 8%
Washer	Stainless steel A4
Hexagon nut	Stainless steel A4, coated

Table A3: Material code for identification of different materials

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

Hilti metal expansion anchor HSA

Product description
Materials and material code

Annex A3

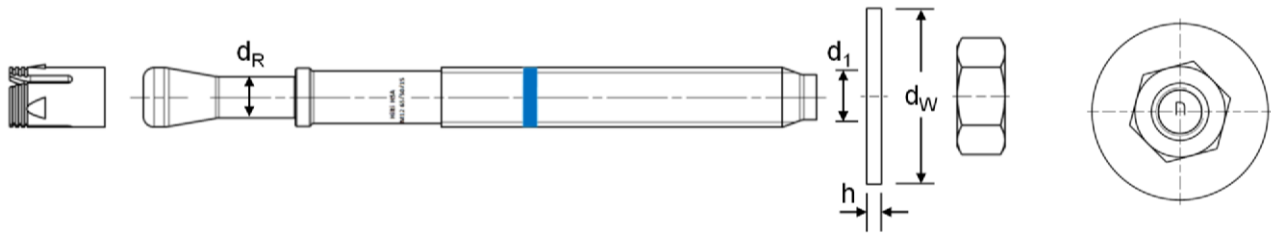
Table A4: Dimensions of Hilti metal expansion anchor HSA, HSA-BW, HSA-F, HSA-R2 and HSA-R

Size			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 metal expansion anchor HSA, HSA-F, HSA-R2, HSA-R



Figure A2: Hilti metal expansion anchor HSA-BW



Hilti metal expansion anchor HSA

Product description
Dimensions

Annex A4

Specifications of intended use

Anchorage subject to:

- Static and quasi static loading.

Base materials:

- Reinforced or unreinforced normal weight concrete according to EN 206-1:2000.
- Strength classes C20/25 to C50/60 according to EN 206-1:2000.
- 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 metal expansion anchor is indicated on the design drawings (e. g. position of the metal expansion anchor relative to reinforcement or to supports, etc.).
- Anchorages under static or quasi static loading are designed in accordance with:
FprEN 1992-4:2016 and EOTA Technical Report TR 055, 12/2016.

Installation:

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

Hilti metal expansion anchor HSA

Intended use
Specifications

Annex B1

Table B1: Drilling technique




Size		M6	M8	M10	M12	M16	M20
Hammer drilling (HD)		✓	✓	✓	✓	✓	✓
Hammer drilling with Hilti hollow drill bit TE-CD/YD ... drilling system (HDB)		-	-	-	✓	✓	✓
Diamond coring (DD) with • DD 30-W coring tool and C+ ... SPX-T (abrasive) core bits		-	-	✓	✓	✓	✓

Table B2: Drill hole cleaning





Manual cleaning (MC): Hilti hand pump for blowing out drill holes.	
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	-
Setting speed	HSA, HSA-BW, HSA-F	-	I	I	III	- ²⁾	
	HSA-R2, HSA-R	-	III				-
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 expansion anchor HSA

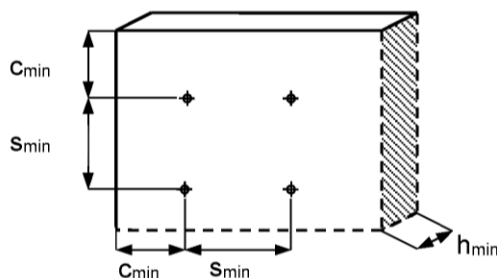
Intended use
Installation methods

Annex B2

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		
Max. cutting diameter of drill bit d_{cut} [mm]	6,4			8,45			10,45			12,5			16,5			20,55		
Max. diameter of clearance hole in the fixture d_f [mm]	7			9			12			14			18			22		
Width across flats SW [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]	5			20			35			80			150			250		
Min. spacing s_{min} [mm]	35			35			40			50			80			120		
Min. edge distance c_{min} [mm]	35			100			150			190			200			225		

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

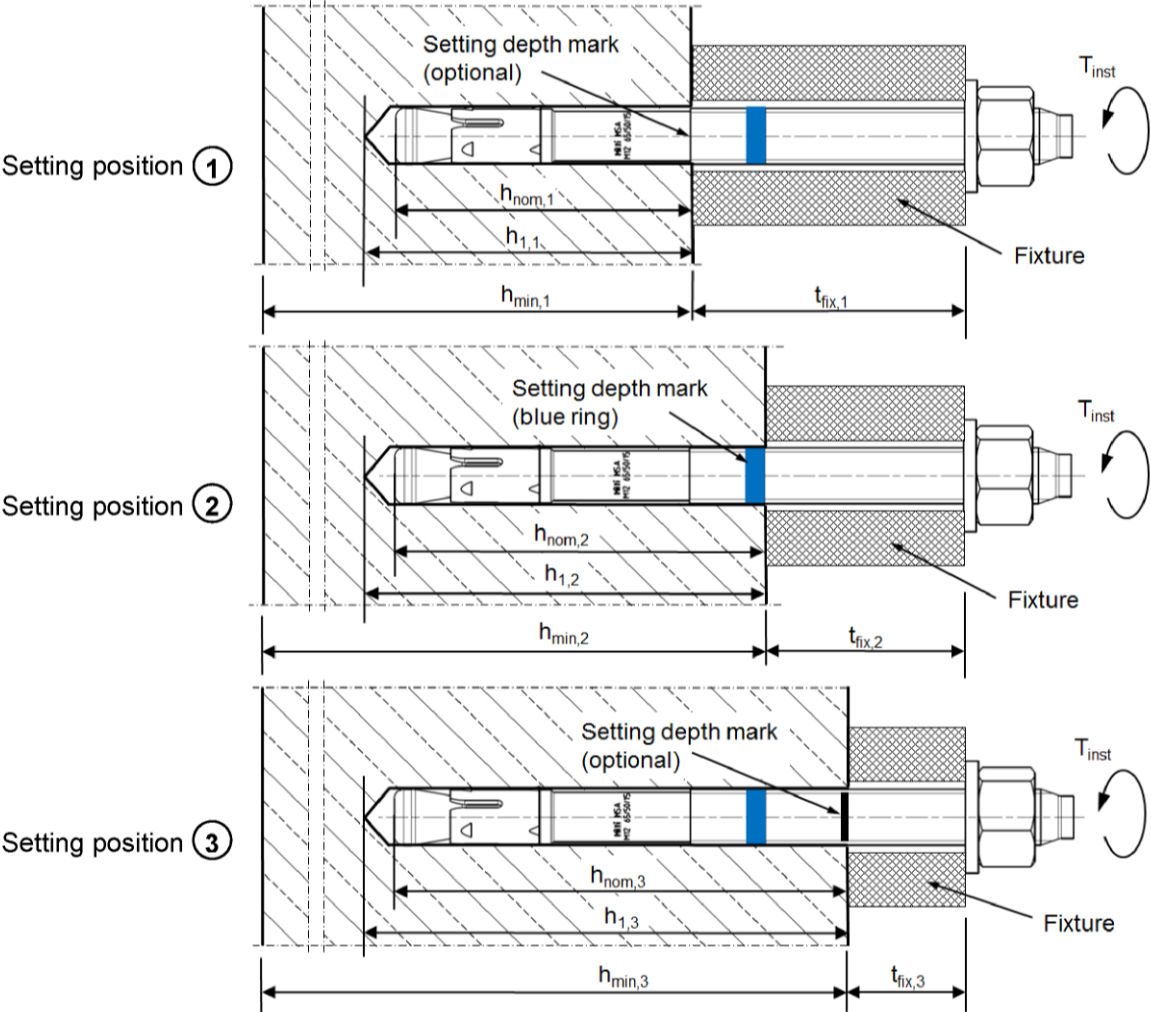


Hilti metal expansion anchor HSA

Intended use
Installation parameters

Annex B3

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



Hilti metal expansion anchor HSA

Intended use
Installation parameters

Annex B4

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

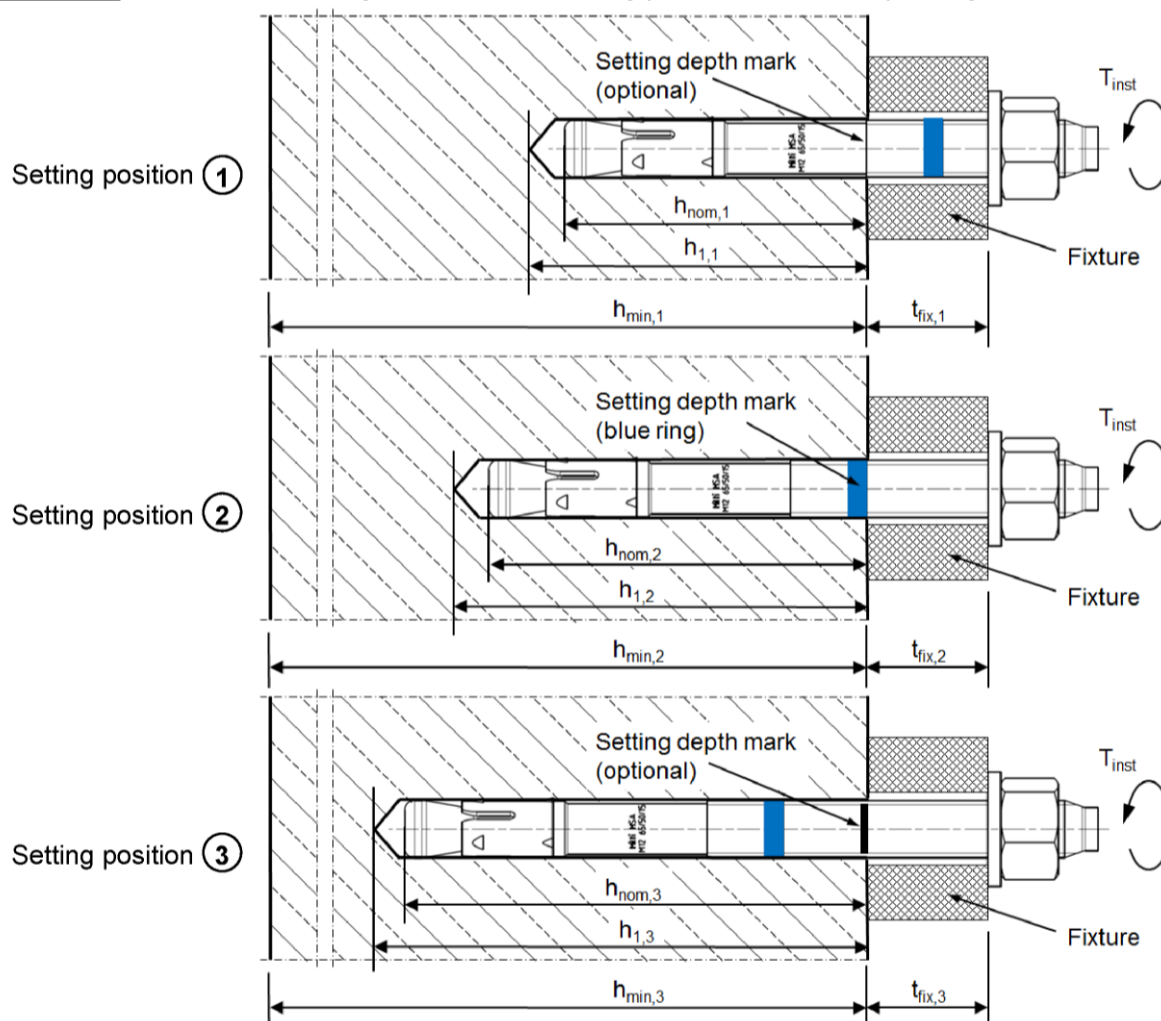


Table B7: Checking setting position

Setting position	Pre-setting	Through setting
①	$h_{nom,1}$ is reached when the non-threaded part of the bolt is completely below the concrete surface. For metal expansion 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 metal expansion 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 metal expansion anchor HSA
②	$h_{nom,2}$ is reached when the blue ring is completely below the concrete surface.	<ul style="list-style-type: none"> position of washer and hexagon nut has to be adjusted or drill hole depth h_1 has to be increased.
③	$h_{nom,3}$ has to be measured and marked by the installer.	

Hilti metal expansion anchor HSA

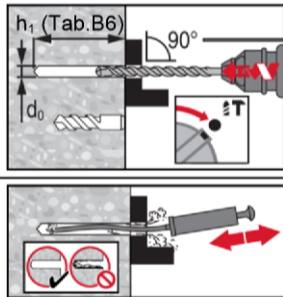
Intended use
Installation parameters

Annex B5

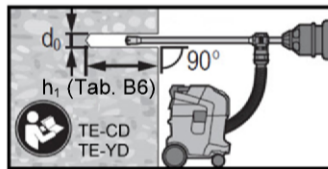
Installation instruction

Hole drilling and cleaning

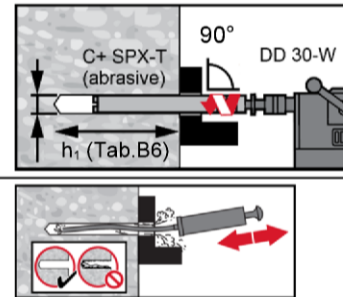
a) Hammer drilling (HD) with manual cleaning (MC): M6 to M20



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

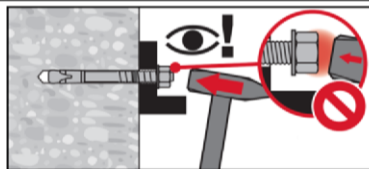


c) Diamond coring (DD) with manual cleaning (MC): M10 to M20

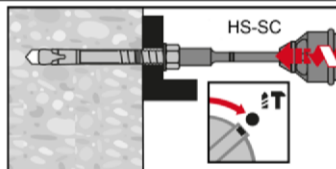


Anchor setting

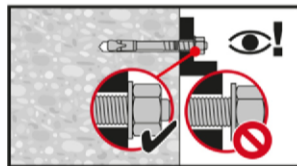
a) Hammer setting: M6 to M20



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

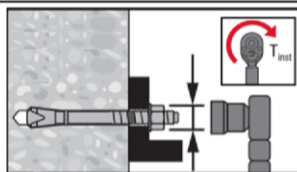


Check setting (see also Table B7)

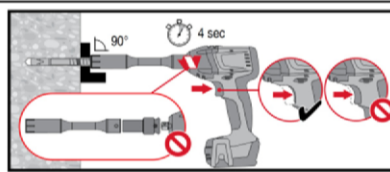


Anchor torquing

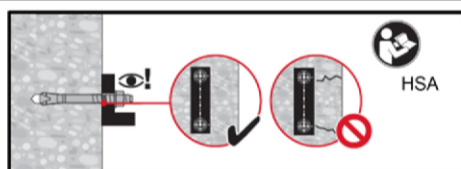
a) Torque wrench: M6 to M20



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



Check installation



Hilti metal expansion anchor HSA

Intended use
Installation instructions

Annex B6

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	$\gamma_{Ms}^{2)}$	[-]	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	γ_{inst}	[-]	1,0																	
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	γ_{inst}	[-]	1,0																	
Factor for non-cracked concrete	$k_1=k_{ucr,N}$	[-]	11,0																	
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 under internal exposure conditions.
2) In absence of other national regulations.
3) Pull-out failure is not decisive for design.

Hilti metal expansion anchor HSA

Performance

Characteristic resistance under tension load in non-cracked concrete

Annex C1

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 $\gamma_{Ms}^{2)}$ [-]	1,25																	
Ductility factor k_7 [-]	1,0																	
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 $\gamma_{Ms}^{2)}$ [-]	1,25																	
Ductility factor k_7 [-]	1,0																	
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		

¹⁾ Use is restricted to anchoring of statically indeterminate structural components under internal exposure conditions.

²⁾ In absence of other national regulations.

Hilti metal expansion anchor HSA

Performance

Characteristic resistance under shear load in non-cracked concrete

Annex C2

Table C2 continued

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
Concrete pry-out failure																		
Installation safety factor γ_{inst} [-]	1,0																	
Pry-out factor k_B [-]	1	2		1	1,5	2		2,4		2			2,9			2	3,5	
Concrete edge failure																		
Installation safety factor γ_{inst} [-]	1,0																	
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 under internal exposure conditions.

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 ¹⁾	40	60	30 ¹⁾	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
Corresponding displacement $\delta_{N\infty}$ [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_{V0} [mm]	1,6			1,9			2,0			2,1			2,2			2,3		
Corresponding displacement $\delta_{V\infty}$ [mm]	2,4			2,9			3,0			3,2			3,3			3,5		

¹⁾ Use is restricted to anchoring of statically indeterminate structural components under internal exposure conditions.

Hilti metal expansion anchor HSA

Performance

Characteristic resistance under shear load in non-cracked concrete;
Displacement under tension and shear loads in non-cracked concrete

Annex C3