Deutsches Institut für Bautechnik
DIBt

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European Technical Assessment Body for construction products

Designated according to Article 29 of Regulation (EU) No 305/2011 and member of EOTA (European Organisation for Technical Assessment)

European Technical Assessment ETA-21/0510 of 14 November 2024

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 HST2-F V3
Product family to which the construction product belongs	Torque-controlled expansion fasteners for use in concrete with variable working life up to 50 years
Manufacturer	Hilti Aktiengesellschaft Feldkircherstrasse 100 9494 SCHAAN FÜRSTENTUM LIECHTENSTEIN
Manufacturing plant	Hilti Werke
This European Technical Assessment contains	23 pages including 3 annexes which form an integral part of this assessment
This European Technical Assessment is issued in accordance with Regulation (EU) No 305/2011, on the basis of	EAD 330232-01-0601-v01

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Specific part

1 Technical description of the product

The Hilti metal expansion anchor HST2-F V3 is an anchor made of hot dip galvanized 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 fastener 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, which is varied depending on the corrosion protection and the environmental conditions but not exceeding 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 Annex C1 and C2
Characteristic resistance to shear load (static and quasi-static loading)	see Annex C3
Displacements	see Annex C4
Durability	see Annex B1 – B3

3.2 Safety in case of fire (BWR 2)

Essential characteristic	Performance
Reaction to fire	Class A1
Resistance to fire	see Annex C5 and C6

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 330232-01-0601-v01 the applicable European legal act is: 1996/582/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.

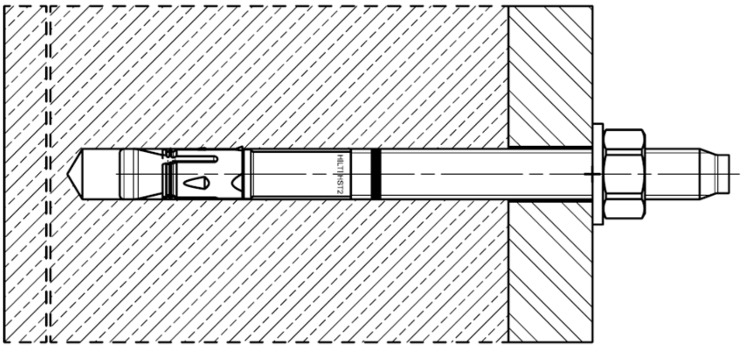
Issued in Berlin on 14 November 2024 by Deutsches Institut für Bautechnik

Dipl.-Ing. Beatrix Wittstock
Head of Section

beglaubigt:
Ziegler

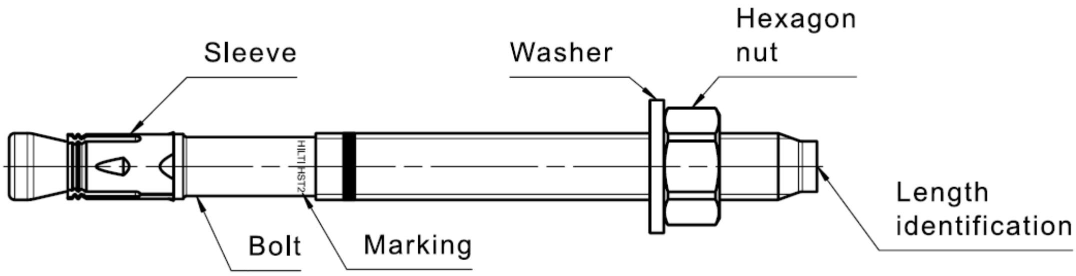
Installed condition

<u>Figure A1:</u>
Hilti metal expansion anchor HST2-F V3



Product description and marking

Cold-formed version HST2-F V3: M8 to M16



HST2-F V3: HILTI HST2-F

Hilti metal expansion anchor HST2-F V3	Annex A1
Product description Installation condition, product, marking and identification	

Table A1: Length identification

Letter			A	B	C	D	E	f	Π
Anchor length	≥	[mm]	38,1	50,8	63,5	76,2	88,9	100,0	100,0
	<	[mm]	50,8	63,5	76,2	88,9	101,6	100,0	100,0

Letter			F	G	Δ	H	I	J	K
Anchor length	≥	[mm]	101,6	114,3	125,0	127,0	139,7	152,4	165,1
	<	[mm]	114,3	127,0	125,0	139,7	152,4	165,1	177,8

Letter			L	M	N	O	P	Q	R
Anchor length	≥	[mm]	177,8	190,5	203,2	215,9	228,6	241,3	254,0
	<	[mm]	190,5	203,2	215,9	228,6	241,3	254,0	279,4

Letter			r	S	T	U	V	W	X
Anchor length	≥	[mm]	260,0	279,4	304,8	330,2	355,6	381,0	406,4
	<	[mm]	260,0	304,8	330,2	355,6	381,0	406,4	431,8

Letter			Y	Z	AA	BB	CC	DD	EE
Anchor length	≥	[mm]	431,8	457,2	482,6	508,0	533,4	558,8	584,2
	<	[mm]	457,2	482,6	508,0	533,4	558,8	584,2	609,6

Letter			FF	GG	HH	II	JJ	KK	LL
Anchor length	≥	[mm]	609,6	635,0	660,4	685,8	711,2	736,6	762,0
	<	[mm]	635,0	660,4	685,8	711,2	736,6	762,0	787,4

Letter			MM	NN	OO	PP	QQ	RR	SS
Anchor length	≥	[mm]	787,4	812,8	838,2	863,6	889,0	914,4	939,8
	<	[mm]	812,8	838,2	863,6	889,0	914,4	939,8	965,2

Letter			TT	UU	VV
Anchor length	≥	[mm]	965,2	990,6	1016,0
	<	[mm]	990,6	1016,0	1041,4

Hilti metal expansion anchor HST2-F V3	**Annex A2**
Product description Length identification	

Table A2: Materials

Designation	Material
HST2-F V3 (Carbon steel, hot dip galvanized ≥ 50µm according to EN ISO 10684:2004 + AC:2009)	
Expansion sleeve	Stainless steel A2 according to ASTM A 240/A 240M: 2019
Bolt	Carbon steel, hot dip galvanized, coated, rupture elongation (l_0 = 5d) > 8 %
Washer	Carbon steel, hot dip galvanized
Hexagon nut	Carbon steel, hot dip galvanized, coated
Filling set (Carbon steel, mechanical zinc plating)	
Sealing washer and Spherical washer	Carbon steel, mechanical zinc plating
Mortar	
Injection mortar	Injection mortar Hilti HIT-HY…

Table A3: Material code for identification of different materials

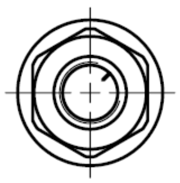
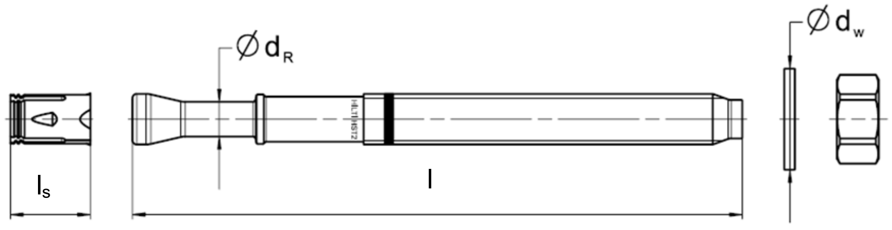
	HST2-F V3
Material code	 Letter code with one mark

Table A4: Dimensions HST2-F V3

Size			M8	M10	M12	M16
Maximum length of anchor	l_{max}	[mm]	230	230	245	245
Shaft diameter at the cone	d_R	[mm]	5,65	6,94	8,22	12
Length of expansion sleeve	l_S	[mm]	13,6	18	19	24,6
Diameter of washer HST2-F V3	d_W ≥	[mm]	15,57	19,48	23,48	29,48

HST2-F V3



Hilti metal expansion anchor HST2-F V3

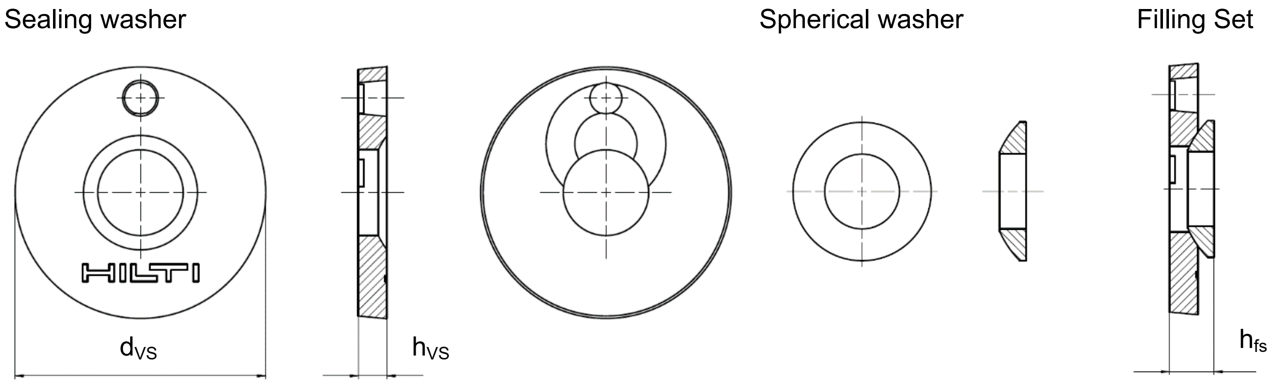
Product description
Materials, dimensions

Annex A3

Filling set to fill the annular gap between the anchor and the fixture

Table A5: Dimensions of the Filling Set

Size			**M8**	**M10**	**M12**	**M16**
Diameter of sealing washer	d_{VS}	[mm]	38	42	44	52
Thickness of sealing washer	h_{VS}	[mm]	5			6
Thickness of the Hilti Filling set	h_{fs}	[mm]	8	9	10	11



Specifications of intended use

Anchorages subject to:

- Static and quasi-static loading: all sizes
- Fire exposure: all sizes.

Base materials:

- Compacted reinforced or unreinforced normal weight concrete without fibers according to EN 206-1:2013+A1:2016.
- Strength classes C20/25 to C50/60 according to EN 206-1:2013+A1:2016.
- Uncracked concrete only.

Use conditions (Environmental conditions):

- Structures subject to dry internal conditions and to external conditions
- Classification of atmospheric corrosivity, determination and estimation C1-CX according to Table B1-B3

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 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 effective embedment depth h_{ef} < 40 mm the use is restricted to anchoring of statically indeterminate fixings (e.g. light weight suspended ceilings) under dry internal conditions only.

Installation:

- Anchor installation carried out by appropriately qualified personnel and under the supervision of the person responsible for technical matters of the site.
- Hole drilling and cleaning with the methods given on Annex B4
- The anchor may only be set once.
- Overhead applications are permitted.

Durability:

- Variable working life according to Table B1

Hilti metal expansion anchor HST2-F V3	**Annex B1**
Intended use Specifications	

Table B1: Durability of hot dip galvanized coatings according to EN ISO 10684:2004+AC:2009 for coatings with mean thickness of minimum 50µm

Corrosivity category	Corrosivity	Durability [years]
C1	Very low	500
C2	Low	75
C3	Medium	25
C4	High	12,5
C5	Very High	5
CX	Extreme	2

Table B2: Description of typical indoor conditions related to the estimation of corrosivity categories according to EN ISO 9223:2012-02 Table C.1

Corrosivity category	Corrosivity	Typical indoor conditions - Examples
C1	Very low	Heated spaces with low relative humidity and insignificant pollution, e.g. offices, schools, museums
C2	Low	Unheated spaces with varying temperature and relative humidity. Low frequency of condensation and low pollution, e.g. storage, sport halls
C3	Medium	Spaces with moderate frequency of condensation and moderate pollution from production process, e.g. food-processing plants, laundries, breweries, dairies
C4	High	Spaces with high frequency of condensation and high pollution from production process, e.g. industrial processing plants, swimming pools
C5	Very High	Spaces with very high frequency of condensation and/or with high pollution from production process, e.g. mines, caverns for industrial purposes, unventilated sheds in subtropical and tropical zones
CX	Extreme	Spaces with almost permanent condensation or extensive periods of exposure to extreme humidity effects and/or with high pollution from production process, e.g. unventilated sheds in humid tropical zones with penetration of outdoor pollution including airborne chlorides and corrosion-simulating particulate matter

Table B3: Description of typical outdoor conditions related to the estimation of corrosivity categories according to EN ISO 9223:2012-02 Table C.1

Corrosivity category	Corrosivity	Typical outdoor conditions - Examples
C1	Very low	Dry or cold zone, atmospheric environment with very low pollution and time of wetness, e.g. certain deserts, Central Arctic/Antarctica
C2	Low	Temperate zone, atmospheric environment with low pollution ($SO_2 < 5$ µg/m³), e.g. rural areas, small towns Dry or cold zone, atmospheric environment with short time of wetness, e.g. deserts, subarctic areas
C3	Medium	Temperate zone, atmospheric environment with medium pollution (SO_2: 5 µg/m³ to 30 µg/m³) or some effect of chlorides, e.g. urban areas, coastal areas with low deposition of chlorides Subtropical and tropical zone, atmosphere with low pollution
C4	High	Temperate zone, atmospheric environment with high pollution (SO_2: 30 µg/m³ to 90 µg/m³) or substantial effect of chlorides, e.g. polluted urban areas, industrial areas, coastal areas without spray of salt water or, exposure to strong effect of de-icing salts Subtropical and tropical zone, atmosphere with medium pollution
C5	Very High	Temperate and subtropical zone, atmospheric environment with very high pollution (SO_2: 90 µg/m³ to 250 µg/m³) and/or significant effect of chlorides, e.g. industrial areas, coastal areas, sheltered positions on coastline
CX	Extreme	Subtropical and tropical zone (very high time of wetness), atmospheric environment with very high SO_2 pollution (higher than 250 µg/m³) including accompanying and production factors and/or strong effect of chlorides, e.g. extreme industrial areas, coastal and offshore areas, occasional contact with salt spray

Table B4: Specifications of intended use

Anchorages subject to:	**M8**	**M10**	**M12**	**M16**
Static and quasi static loading in uncracked concrete - hammer drilling and diamond coring	✓	✓	✓	✓
Fire exposure - hammer drilling and diamond coring	✓	✓	✓	✓

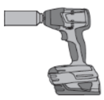
Table B5: Drilling technique

Anchorages subject to:		**M8**	**M10**	**M12**	**M16**
Hammer drilling (HD)		✓	✓	✓	✓
Diamond coring (DD) with • DD EC-1 coring tool and DD-C … TS/TL core bits or DD-C … T2/T4 core bits • DD 30-W coring tool and C+ … SPX-T (abrasive) core bits • DD 150-U coring tool and SPX-L, SPX-L Abrasive or SPX-L Hand Held core bits		✓	✓	✓	✓

Table B6: Drill hole cleaning

Manual cleaning (MC): Hilti hand pump for blowing out drill holes	
Compressed air cleaning (CAC): Air nozzle with an orifice opening of 3,5 mm in diameter	
Non-cleaning (NC): Non-cleaning by 3 x venting	-

Table B7: Methods for application of torque moment

HST2-F V3		**M8**	**M10**	**M12**	**M16**
Torque wrench		✓	✓	✓	✓
Machine torqueing with Hilti SIW impact wrench and SI-AT adaptive torque module					
• SIW 4AT-22 with SI-AT-22[1)]		✓	✓	✓	-
• SIW 6AT-22 with SI-AT-22[1)]		-	-	✓	✓

[1)] Equivalent combination of Hilti SIW + SI-AT tool, compatible to this anchor type, may be used

Hilti metal expansion anchor HST2-F V3	**Annex B4**
Intended use Specifications	

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Table B8: Installation parameters for HST2-F V3

HST2-F V3			M8			M10			M12			M16		
Nominal diameter of drill bit	d_0	[mm]	8			10			12			16		
Maximum cutting diameter of drill bit	d_{cut}	[mm]	8,45			10,45			12,50			16,50		
Maximum diameter of clearance hole in the fixture [1)]	d_f	[mm]	9			12			14			18		
Effective embedment depth	h_{ef}	[mm]	30	45	70	40	60	80	50	70	100	65	85	120
Nominal embedment depth	h_{nom}	[mm]	h_{ef} + 10			h_{ef} + 10			h_{ef} + 13			h_{ef} + 13		
Minimum depth of drill hole (hammer drilled, not cleaned)	$h_1 \geq$	[mm]	h_{ef} + 30			h_{ef} + 30			h_{ef} + 33			h_{ef} + 33		
Minimum depth of drill hole (hammer drilled, cleaned)	$h_1 \geq$	[mm]	h_{ef} + 15			h_{ef} + 15			h_{ef} + 21			h_{ef} + 21		
Minimum depth of drill hole (diamond cored boreholes)	$h_1 \geq$	[mm]	h_{ef} + 20			h_{ef} + 20			h_{ef} + 23			h_{ef} + 23		
Minimum thickness of concrete member [2)]	$h_{min} \geq$	[mm]	max(100; 1,5h_{ef})			max(120; 1,5h_{ef})			max(140; 1,5h_{ef})			max(160; 1,5h_{ef})		
Minimum concrete thickness below borehole bottom [2)]	$h_b \geq$	[mm]	21			27			32			34		
Width across flats	SW	[mm]	13			17			19			24		
Installation torque HST2-F V3	T_{inst}	[Nm]	25			40			50			110		

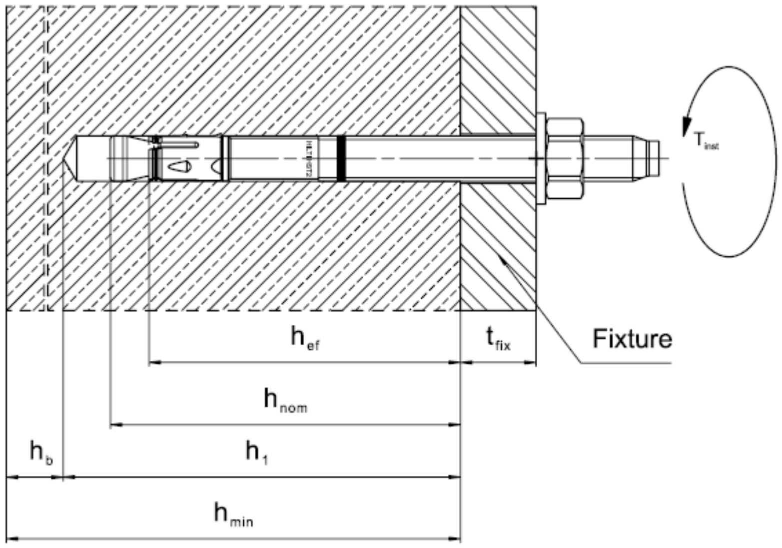
[1)] For the design of bigger clearance holes in the fixture see EN 1992-4:2018.

[2)] Under consideration of minimum concrete thickness below borehole bottom: $h_{min} \geq h_1 + h_b$

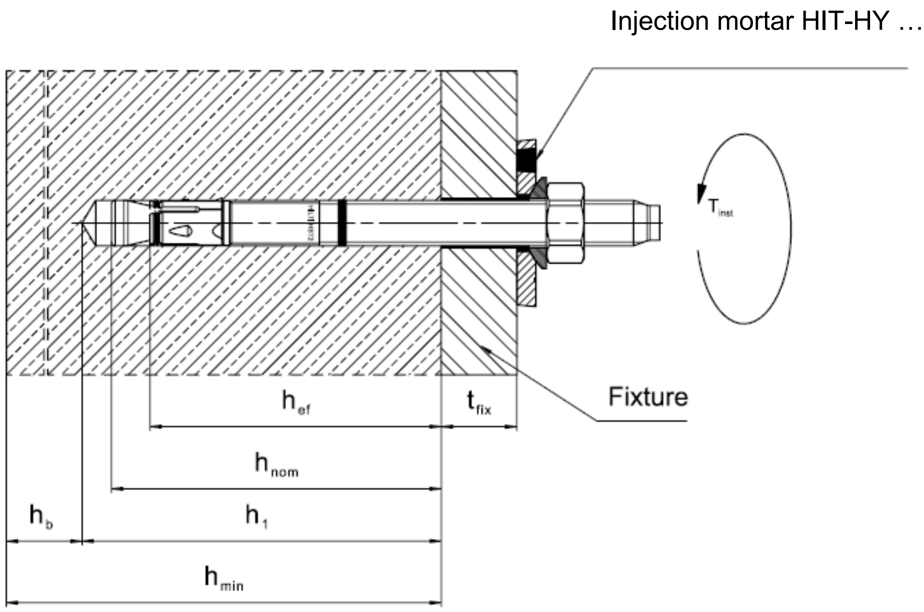
Hilti metal expansion anchor HST2-F V3	**Annex B5**
Intended use Installation parameters	

Setting positions for HST2-F V3

Without the Filling Set to fill the annular gap between the anchor and the fixture



With the Filling Set to fill the annular gap between the anchor and the fixture

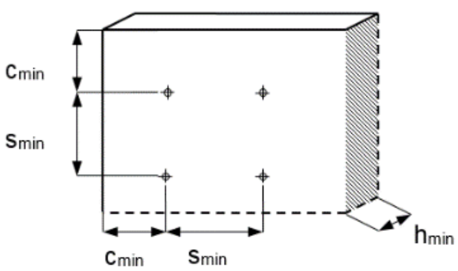


Hilti metal expansion anchor HST2-F V3	**Annex B6**
Intended use Installation parameters, setting position	

Table B9: Minimum spacing and edge distance for HST2-F V3

			M8			M10			M12			M16		
Effective embedment depth	h_{ef}	[mm]	30	45	70	40	60	80	50	70	100	65	85	120
Hammer drilled, not cleaned boreholes														
Minimum thickness of concrete member	h_{min}	[mm]	100	100	125	120	120	140	140	140	165	160	160	190
Minimum spacing [1)]	s_{min}	[mm]	40			55			60			70		
	for c ≥	[mm]	55	55	45	75	75	60	75	75	65	85	85	75
Minimum edge distance [1)]	c_{min}	[mm]	45			55			55			70		
	for s ≥	[mm]	65	60	40	105	105	65	125	110	95	105	105	80
Hammer drilled, cleaned boreholes														
Minimum thickness of concrete member	h_{min}	[mm]	100	100	110	120	120	125	140	140	155	160	160	180
Minimum spacing [1)]	s_{min}	[mm]	40			55			60			70		
	for c ≥	[mm]	55	55	50	75	75	70	75	75	65	85	85	75
Minimum edge distance [1)]	c_{min}	[mm]	45			55			55			70		
	for s ≥	[mm]	65	60	50	105	105	95	125	110	115	105	105	95
Diamond cored boreholes														
Minimum thickness of concrete member	h_{min}	[mm]	100	100	115	120	120	130	140	140	155	160	160	180
Minimum spacing [1)]	s_{min}	[mm]	40			55			60			70		
	for c ≥	[mm]	55	55	45	75	75	65	75	75	65	85	85	75
Minimum edge distance [1)]	c_{min}	[mm]	45			55			55			70		
	for s ≥	[mm]	65	60	40	105	105	85	125	110	115	105	105	95

[1)] Linear interpolation for s_{min} and c_{min} allowed



Hilti metal expansion anchor HST2-F V3

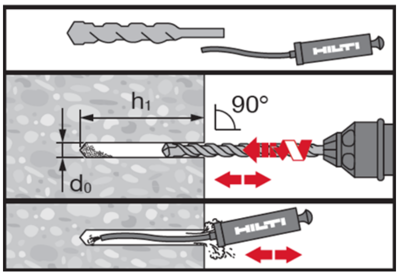
Intended Use
Minimum spacing and minimum edge distance

Annex B7

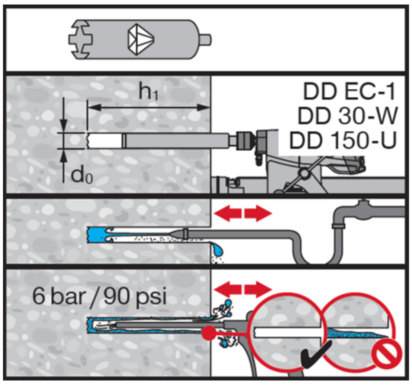
Installation instruction

Hole drilling and cleaning

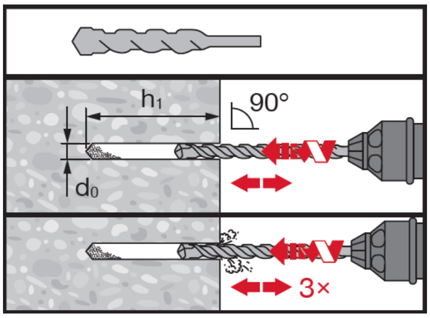
a) Hammer drilling (HD): M8 to M16



b) Diamond coring (DD): M8 to M16

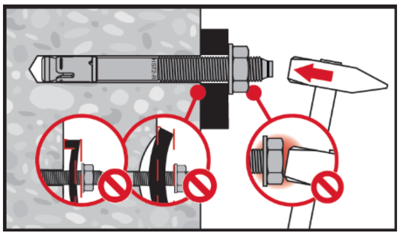


c) Hammer drilling non-cleaned (HD NC): M8 to M16

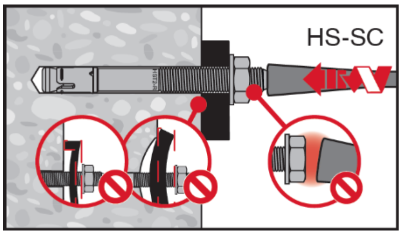


Anchor setting

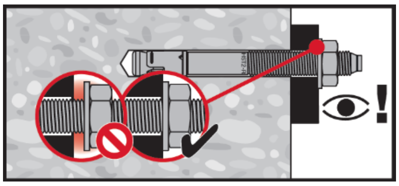
a) Hammer setting: M8 to M16



b) Machine setting (setting tool): M8 to M16

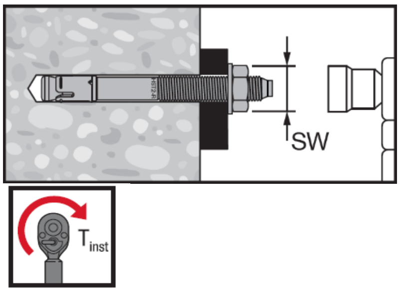


Check setting

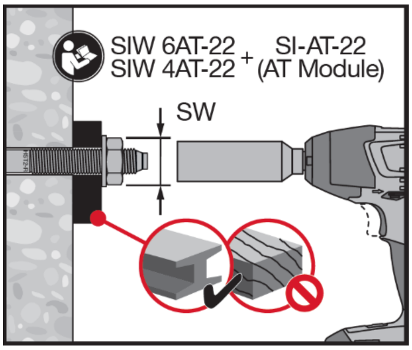


Anchor torqueing

a) Torque wrench: M8 to M16



b) Machine torqueing: M8 to M16



Hilti metal expansion anchor HST2-F V3	**Annex B8**
Intended Use Installation instructions	

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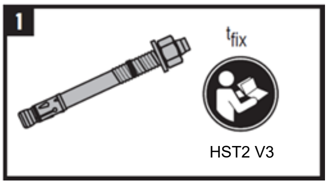
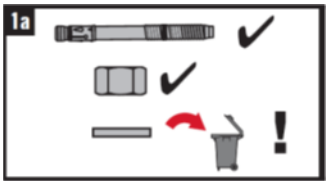
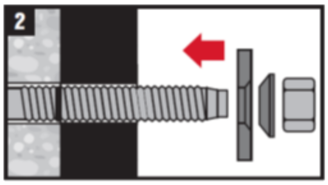
Installation with Filling Set

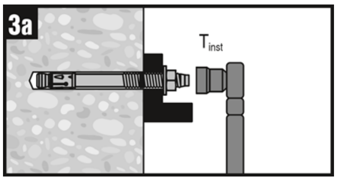
Installation of sealing washer

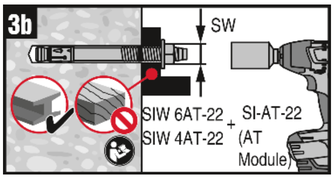




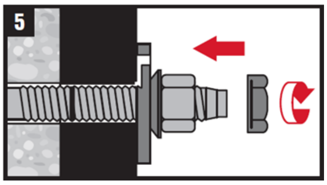


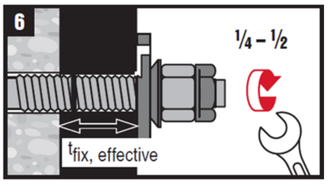
Anchor torqueing



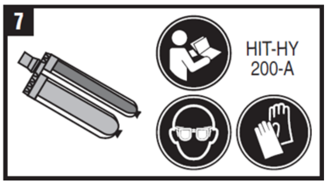


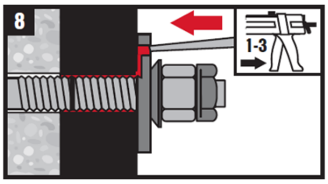
Installation of counter nut (optional)

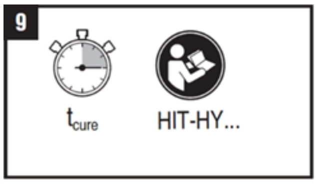




Injection of mortar







Hilti metal expansion anchor HST2-F V3	**Annex B9**
Intended Use Installation instructions	

Table C1: Characteristic values of resistance under tension load in case of static and quasi-static loading in uncracked concrete C20/25

			M8			M10			M12			M16		
Effective embedment depth	h_{ef}	[mm]	30	45	70	40	60	80	50	70	100	65	85	120
Steel failure														
Characteristic resistance	$N_{Rk,s}$	[kN]	16,5			28,0			41,4			82,6		
Partial safety factor	$\gamma_{Ms,N}$ 1)	[-]	1,40											
Pull-out failure														
HST2-F V3 with Hammer drilling														
Characteristic resistance	$N_{Rk,p}$	[kN]	8,1	13,0	16,0	12,4	18,0	24,0	17,4	26,3	34,0	25,8	35,3	44,0
HST2-F V3 with Diamond coring														
Characteristic resistance	$N_{Rk,p}$	[kN]	6,0	10,5	13,0	10,0	15,3	20,0	17,4	26,3	34,0	25,8	35,3	44,0
Increasing factor for $N_{Rk,p}$ $\psi_c = (f_{ck}/20)^{0,5}$	ψ_C	C30/37	1,22											
	ψ_C	C40/50	1,41											
	ψ_C	C50/60	1,58											

1) In absence of other national regulations

Hilti metal expansion anchor HST2-F V3	**Annex C1**
Performances Characteristic resistance under tension load	

Table C1 continued

			M8			M10			M12			M16		
Effective embedment depth	h_{ef}	[mm]	30	45	70	40	60	80	50	70	100	65	85	120
Concrete cone failure and Splitting failure														
Installation factor	γ_{inst}	[-]	1,0											
Factor for uncracked concrete	$k_1 = k_{ucr,N}$	[-]	11,0											
Spacing	$s_{cr,N}$	[mm]	3 h_{ef}											
Edge distance	$c_{cr,N}$	[mm]	1,5 h_{ef}											
Characteristic resistance to splitting	$N^0_{Rk,sp}$	[kN]	Min ($N_{Rk,p}$; $N^0_{Rk,c}$) [1)]											
Spacing (splitting)	$s_{cr,sp}$	[mm]	2 · $c_{cr,sp}$											
Hammer drilled, not cleaned boreholes														
distance (Edge splitting)	$c_{cr,sp}$	[mm]	76	96	105	97	146	173	91	142	160	105	168	194
Hammer drilled, cleaned boreholes														
distance (Edge splitting)	$c_{cr,sp}$	[mm]	76	96	105	97	146	193	91	142	170	105	168	204
Diamond cored boreholes														
distance (Edge splitting)	$c_{cr,sp}$	[mm]	67	85	105	73	122	152	91	142	170	105	168	204

1) $N^0_{Rk,c}$ according to EN 1992-4:2018

Hilti metal expansion anchor HST2-F V3	**Annex C2**
Performances Characteristic resistance under tension load	

Table C2: Characteristic values of resistance under shear load in case of static and quasi-static loading

			M8			M10			M12			M16		
Effective embedment depth	h_{ef}	[mm]	30	45	70	40	60	80	50	70	100	65	85	120
Steel failure without lever arm														
Characteristic resistance	$V^0_{Rk,s}$	[kN]	10,6			18,9			29,5			51,0		
Characteristic resistance using Filling Set	$V^0_{Rk,s}$	[kN]	10,6			18,9			29,5			51,0		
Partial safety factor	$\gamma_{Ms,V}$ [1]	[-]	1,25											
Ductility factor	k_7	[-]	1,0											
Steel failure with lever arm														
Characteristic resistance	$M^0_{Rk,s}$	[Nm]	21,7			48,6			91,7			216		
Partial safety factor	$\gamma_{Ms,V}$ [1]	[-]	1,25											
Concrete pry-out failure														
Pryout factor	k_8	[-]	2,34			2,55			2,57			2,82		
Installation safety factor	γ_{inst}	[-]	1,00											
Concrete edge failure														
Effective length of anchor in shear loading	$l_f = h_{ef}$	[mm]	30	45	70	40	60	80	50	70	100	65	85	120
Diameter of anchor	d_{nom}	[mm]	8			10			12			16		
Installation safety factor	γ_{inst}	[-]	1,00											

[1] In absence of other national regulations

Hilti metal expansion anchor HST2-F V3	**Annex C3**
Performances Characteristic resistance under shear load	

Table C3: Displacements under tension and shear loads in case of static and quasi-static loading

			M8			M10			M12			M16		
Displacements under tension loading														
Effective embedment depth	h_{ef}	[mm]	30	45	70	40	60	80	50	70	100	65	85	120
Tension load in uncracked concrete	N	[kN]	7,6			11,4			16,2			21,0		
Corresponding displacement	δ_{N0}	[mm]	0,96			0,31			2,17			2,07		
	$\delta_{N\infty}$	[mm]	1,70			1,28			1,73			1,13		
Displacements under shear loading														
Effective embedment depth	h_{ef}	[mm]	30	45	70	40	60	80	50	70	100	65	85	120
Shear load in cracked and uncracked concrete	V	[kN]	6,1			10,8			16,9			29,1		
Corresponding displacement	δ_{V0}	[mm]	2,28			2,28			2,21			2,41		
	$\delta_{V\infty}$	[mm]	3,42			3,42			3,32			3,62		

Hilti metal expansion anchor HST2-F V3

Performances
Displacements

Annex C4

Table C4: Characteristic tension resistance under fire exposure in uncracked concrete

				M8			M10			M12			M16		
Steel failure															
Effective embedment depth		h_{ef}	[mm]	30	45	70	40	60	80	50	70	100	65	85	120
Characteristic resistance	R30	$N_{Rk,s,fi}$	[kN]	0,4	1,2	1,2	0,9	2,6	2,6	1,7	4,8	4,8	3,1	9,0	9,0
	R60	$N_{Rk,s,fi}$	[kN]	0,3	1,0	1,0	0,8	2,1	2,1	1,3	3,8	3,8	2,4	7,0	7,0
	R90	$N_{Rk,s,fi}$	[kN]	0,3	0,8	0,8	0,6	1,5	1,5	1,1	2,7	2,7	2,0	5,0	5,0
	R120	$N_{Rk,s,fi}$	[kN]	0,2	0,6	0,6	0,5	1,2	1,2	0,8	2,1	2,1	1,6	4,0	4,0
Pullout failure															
Effective embedment depth		h_{ef}	[mm]	30	45	70	40	60	80	50	70	100	65	85	120
Characteristic resistance in concrete ≥ C20/25	R30	$N_{Rk,p,fi}$	[kN]	$0{,}25 \cdot N_{Rk,p}$ [1)]											
	R60	$N_{Rk,p,fi}$	[kN]												
	R90	$N_{Rk,p,fi}$	[kN]												
	R120	$N_{Rk,p,fi}$	[kN]	$0{,}20 \cdot N_{Rk,p}$ [1)]											
Concrete cone failure															
Effective embedment depth		h_{ef}	[mm]	30	45	70	40	60	80	50	70	100	65	85	120
Characteristic resistance in concrete ≥ C20/25	R30	$N^0_{Rk,c,fi}$	[kN]	$h_{ef} / 200 \cdot N^0_{Rk,c} \leq N^0_{Rk,c}$											
	R60	$N^0_{Rk,c,fi}$	[kN]												
	R90	$N^0_{Rk,c,fi}$	[kN]												
	R120	$N^0_{Rk,c,fi}$	[kN]	$0{,}8 \cdot h_{ef} / 200 \cdot N^0_{Rk,c} \leq N^0_{Rk,c}$											
Spacing		$s_{cr,N}$	[mm]	4 h_{ef}											
		s_{min}	[mm]	40			55			60			70		
Edge distance		$c_{cr,N}$	[mm]	2 h_{ef}											
		c_{min}	[mm]	Fire attack from one side: 2 h_{ef} Fire attack from more than one side: ≥ 300											

[1)] $N_{Rk,p}$ is the characteristic resistance for pull-out failure $N_{Rk,p}$ (see Table C1) under ambient temperature. In absence of other national regulations the partial safety factor for resistance under fire exposure $\gamma_{M,fi}$ = 1,0 is recommended.

Hilti metal expansion anchor HST2-F V3	**Annex C5**
Performances Characteristic values of resistance under tension loading under fire exposure in uncracked concrete	

Table C5: Characteristic shear resistance under fire exposure in uncracked concrete

				M8			M10			M12			M16		
Steel failure without lever arm															
Effective embedment depth		h_{ef}	[mm]	30	45	70	40	60	80	50	70	100	65	85	120
Characteristic resistance	R30	$V_{Rk,s,fi}$	[kN]	0,4	1,2	1,2	0,9	2,6	2,6	1,7	4,8	4,8	3,1	9,0	9,0
	R60	$V_{Rk,s,fi}$	[kN]	0,3	1,0	1,0	0,8	2,1	2,1	1,3	3,8	3,8	2,4	7,0	7,0
	R90	$V_{Rk,s,fi}$	[kN]	0,3	0,8	0,8	0,6	1,5	1,5	1,1	2,7	2,7	2,0	5,0	5,0
	R120	$V_{Rk,s,fi}$	[kN]	0,2	0,6	0,6	0,5	1,2	1,2	0,8	2,1	2,1	1,6	4,0	4,0
Steel failure with lever arm															
Effective embedment depth		h_{ef}	[mm]	30	45	70	40	60	80	50	70	100	65	85	120
Characteristic resistance	R30	$M^0_{Rk,s,fi}$	[Nm]	1,3			3,4			7,5			19,1		
	R60	$M^0_{Rk,s,fi}$	[Nm]	1,0			2,7			5,8			14,8		
	R90	$M^0_{Rk,s,fi}$	[Nm]	0,8			2,0			4,2			10,6		
	R120	$M^0_{Rk,s,fi}$	[Nm]	0,7			1,6			3,3			8,5		
Concrete pryout failure															
Effective embedment depth		h_{ef}	[mm]	30	45	70	40	60	80	50	70	100	65	85	120
Pryout factor		k_8	[-]	2,34			2,55			2,57			2,82		
Characteristic resistance in concrete ≥ C20/25	R30	$V_{Rk,cp,fi}$	[kN]	$k_8 \cdot N_{Rk,c,fi(90)}$ 1)											
	R60	$V_{Rk,cp,fi}$	[kN]												
	R90	$V_{Rk,cp,fi}$	[kN]												
	R120	$V_{Rk,cp,fi}$	[kN]	$k_8 \cdot N_{Rk,c,fi(120)}$ 1)											
Concrete edge failure															
Concrete edge failure in concrete C20/25 to C50/60 under fire exposure $V^0_{Rk,c,fi} = 0,25 \times V^0_{Rk,c}$ (≤ R90) $V^0_{Rk,c,fi} = 0,20 \times V^0_{Rk,c}$ (R120) with $V^0_{Rk,c}$ = initial value of the characteristic resistance under normal temperature, according EN 1992-4:2018															

1) $N_{Rk,c,fi(90)}$ and $N_{Rk,c,fi(120)}$ see Annex C5 with $N^0_{Rk,c,fi}$ under fire exposure for 90 or 120 minutes respectively
In absence of other national regulations, the partial safety factor for resistance under fire exposure $\gamma_{M,fi} = 1,0$ is recommended.