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-15/0435 of 7 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 HST2 and HST2-R
Product family to which the construction product belongs	Mechanichal fastener for use in concrete
Manufacturer	Hilti AG Feldkircherstraße 100 9494 Schaan FÜRSTENTUM LIECHTENSTEIN
Manufacturing plant	Hilti Aktiengesellschaft
This European Technical Assessment contains	20 pages including 3 annexes
This European Technical Assessment is issued in accordance with Regulation (EU) No 305/2011, on the basis of	European Assessment Document (EAD) 330232-00-0601

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Specific Part

1 Technical description of the product

The Hilti metal expansion anchor HST2 and HST2-R is an anchor made of galvanized steel (HST2) or stainless steel (HST2-R) 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 under static and quasi-static loading, displacements	See Annex C1 to C4

3.2 Safety in case of fire (BWR 2)

Essential characteristic	Performance
Reaction to fire	Anchorages satisfy requirements for Class A1
Resistance to fire	See Annex C5 to 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 330232-00-0601, 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 7 August 2017 by Deutsches Institut für Bautechnik

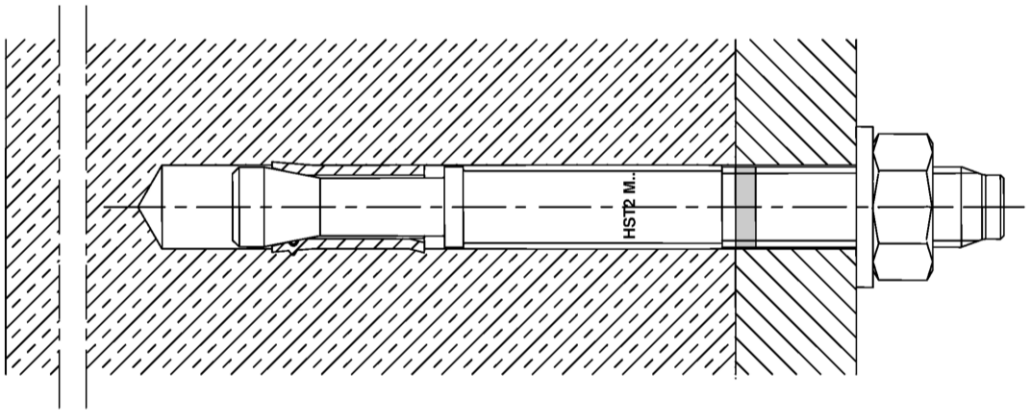
BD Dipl.-Ing. Andreas Kummerow
Head of Department

beglaubigt:
Lange

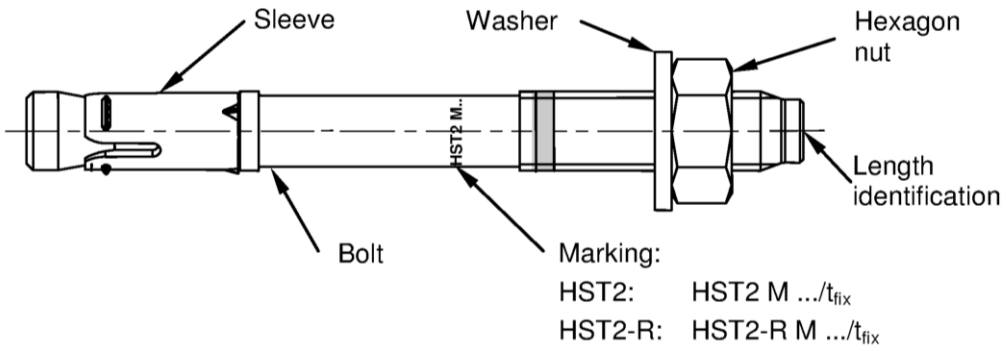
Deutsches Institut für Bautechnik

DIBt

Installed condition for HST2 and HST2-R



Product description and marking for HST2 and HST2-R



Hilti metal expansion anchor HST2 and HST2-R	Annex A1
Product description Installation condition, anchor types, marking and identification	

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Table A1: Length identification HST2 and HST2-R

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 and HST2-R

Product description
Installation condition, anchor types, marking and identification

Annex A2

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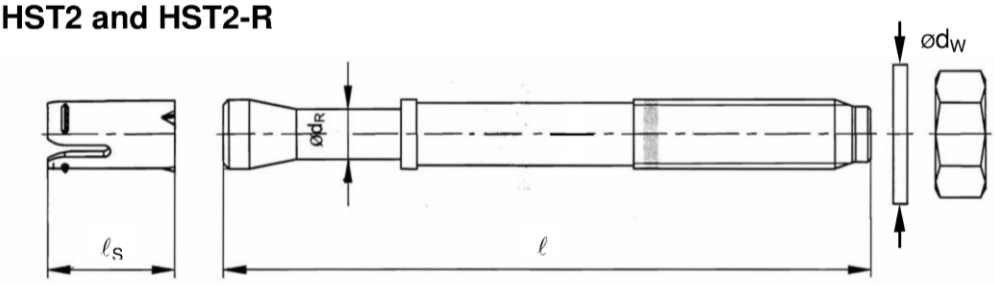
Table A2: Materials

Designation	Material
HST2 (Carbon steel)	
Expansion sleeve	Stainless steel A2
Bolt	Carbon steel, galvanized, coated (transparent), rupture elongation (l_0 = 5d) > 8 %
Washer	Carbon steel, galvanized
Hexagon nut	Carbon steel, galvanized
HST2-R (Stainless steel A4)	
Expansion sleeve	Stainless steel A4
Bolt	Stainless steel A4 or Duplex A4, cone coated (transparent), rupture elongation (l_0 = 5d) > 8 %
Washer	Stainless steel A4
Hexagon nut	Stainless steel A4, coated

Table A3: Dimensions HST2 and HST2-R

HST2, HST2-R			M8	M10	M12	M16
Maximum length of anchor	ℓ_{max}	[mm]	260	280	295	350
Shaft diameter at the cone	d_R	[mm]	5,5	7,2	8,5	11,6
Length of expansion sleeve	ℓ_S	[mm]	14,8	18,2	22,7	24,3
Diameter of washer	$d_W \geq$	[mm]	15,57	19,48	23,48	29,48

HST2 and HST2-R



Hilti metal expansion anchor HST2 and HST2-R	Annex A3
Product description Materials and dimensions	

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Specifications of intended use

Anchorages subject to:

- Static and quasi static loading.
- Static and quasi static loading under fire exposure.

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.
- Cracked and non-cracked concrete.

Use conditions (Environmental conditions):

- Hilti metal expansion anchor HST2 made of galvanized steel:
  Structures subject to dry internal conditions.
- Hilti metal expansion anchor HST2-R made of stainless steel A4:
  Structures subject to dry internal conditions and also in structures subject to external atmospheric exposure (including industrial and marine environment), or exposure in permanently damp internal conditions, if no particular aggressive conditions exist. Such 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 materials 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 actions are designed in accordance with:
  FprEN 1992-4:2016 and EOTA Technical Report TR 055, 12/2016
- Anchorages under fire exposure are designed in accordance with:
  FprEN 1992-4:2016 and EOTA Technical Report TR 020, 4/2004
  In case of requirements to resistance to fire local spalling of the concrete cover must be avoided.

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.
- Overhead applications are permitted.

Hilti metal expansion anchor HST2 and HST2-R	
Specifications of intended use	**Annex B1**

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Table B1: Drilling technique

HST2, HST2-R	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 	✓	✓	✓	✓
Hammer drilling with Hilti hollow drill bit TE-CD/YD … drilling system (HDB) 	-	-	✓	✓

Table B2: 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	
Automated cleaning (AC): Cleaning is performed during drilling with Hilti TE-CD and TE-YD drilling system including vacuum cleaner	

Hilti metal expansion anchor HST2 and HST2-R	Annex B2
Specifications of intended use	

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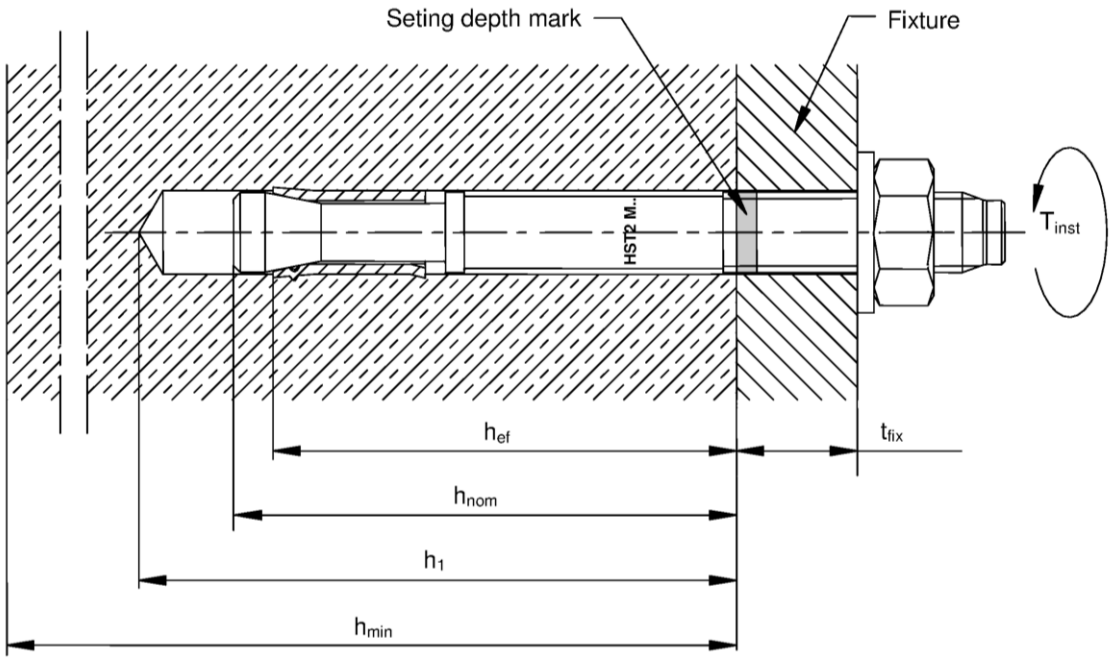
Table B3: Installation parameters for HST2 and HST2-R

HST2, HST2-R			M8	M10	M12	M16
Nominal diameter of drill bit	d_0	[mm]	8	10	12	16
Cutting diameter of drill bit	$d_{cut} \leq$	[mm]	8,45	10,45	12,50	16,50
drill hole depth[1)]	$h_1 \geq$	[mm]	60	74	88	103
Effective embedment depth	h_{ef}	[mm]	47	60	70	82
Thread engagement length	h_{nom}	[mm]	55	69	80	95
Maximum diameter of clearance hole in the fixture	d_f	[mm]	9	12	14	18
Installation torque moment	T_{inst}	[Nm]	20	45	60	110
Maximum thickness of fixture	$t_{fix,max}$	[mm]	195	200	200	235
Width across flats	SW	[mm]	13	17	19	24

[1)] In case of diamond drilling + 5 mm for M8 to M10 and + 2 mm for M12 to M16



Hilti metal expansion anchor HST2 and HST2-R

Specifications of intended use
Installation parameters

Annex B3

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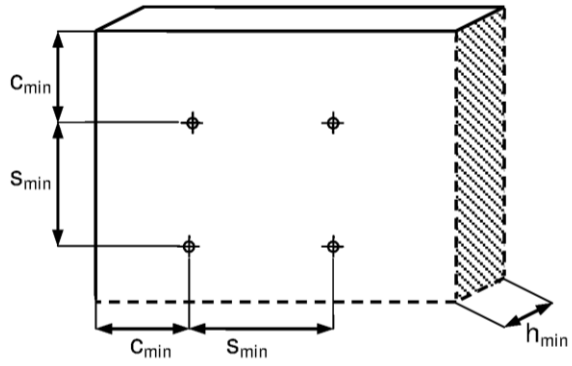
Table B4: Minimum spacing and edge distance for HST2 and HST2-R

			M8	M10	M12	M16
Minimum thickness of concrete member	$h_{min,1}$	[mm]	100	120	140	160
Cracked concrete						
HST2						
Minimum spacing [1)]	s_{min}	[mm]	40	55	60	70
	for c ≥	[mm]	50	70	75	100
Minimum edge distance [1)]	c_{min}	[mm]	45	55	55	70
	for s ≥	[mm]	50	90	120	150
HST2-R						
Minimum spacing [1)]	s_{min}	[mm]	40	55	60	70
	for c ≥	[mm]	50	65	75	100
Minimum edge distance [1)]	c_{min}	[mm]	45	50	55	60
	for s ≥	[mm]	50	90	110	160

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



Hilti metal expansion anchor HST2 and HST2-R

Intended Use
Minimum spacing and minimum edge distance

Annex B4

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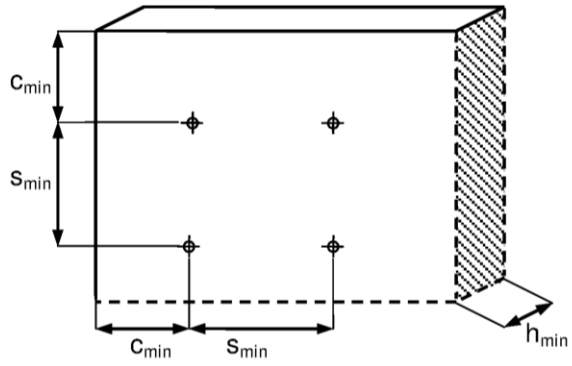
Table B4 continued

			M8	M10	M12	M16
Minimum thickness of concrete member	$h_{min,1}$	[mm]	100	120	140	160
Non-cracked concrete						
HST2						
Minimum spacing [1]	s_{min}	[mm]	60	55	60	70
	for c ≥	[mm]	50	80	85	110
Minimum edge distance [1]	c_{min}	[mm]	50	55	55	85
	for s ≥	[mm]	60	115	145	150
HST2-R						
Minimum spacing [1]	s_{min}	[mm]	60	55	60	70
	for c ≥	[mm]	60	70	80	110
Minimum edge distance [1]	c_{min}	[mm]	60	50	55	70
	for s ≥	[mm]	60	115	145	160

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



Hilti metal expansion anchor HST2 and HST2-R

Intended Use
Minimum spacing and minimum edge distance

Annex B5

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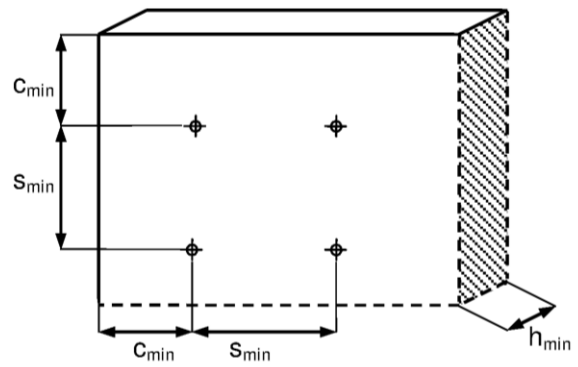
Table B4 continued

			M8	M10	M12	M16
Minimum thickness of concrete member	$h_{min,2}$	[mm]	80	100	120	140
Cracked concrete						
HST2 and HST2-R						
Minimum spacing	s_{min}	[mm]	50	55	60	80
	for c ≥	[mm]	60	110	100	140
Minimum edge distance	c_{min}	[mm]	55	70	70	80
	for s ≥	[mm]	60	100	130	180
Non-cracked concrete						
HST2 and HST2-R						
Minimum spacing	s_{min}	[mm]	60	55	60	80
	for c ≥	[mm]	75	115	100	140
Minimum edge distance	c_{min}	[mm]	70	70	70	80
	for s ≥	[mm]	80	110	130	180

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



Hilti metal expansion anchor HST2 and HST2-R

Intended Use
Minimum spacing and minimum edge distance

Annex B6

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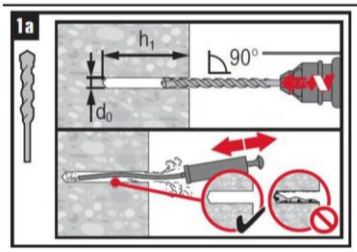
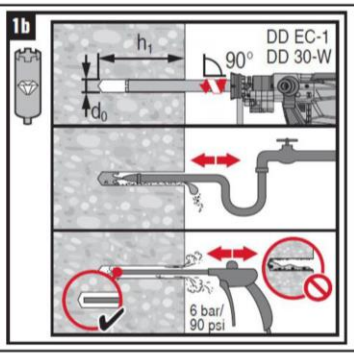
Installation instruction

Hole drilling and cleaning

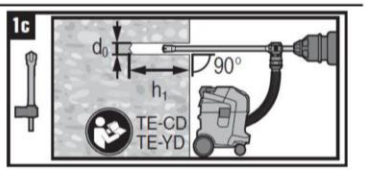
a) Hammer drilling (HD):
M8 to M16



b) Diamond coring (DD):
M8 to M16

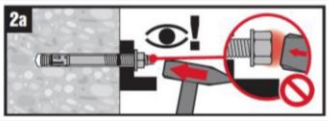


c) Hammer drilling with Hilti hollow drill bit (HDB):
M12 to M16

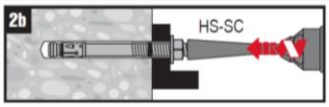


Anchor setting

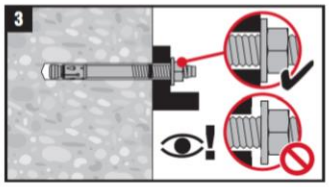
a) Hammer setting:
M8 to M16



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

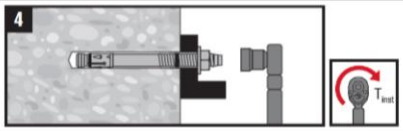


Check setting



Anchor torqueing

a) Torque wrench:
M8 to M16



Hilti metal expansion anchor HST2 and HST2-R	
Intended Use Installation instructions	**Annex B7**

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Table C1: Characteristic tension resistance for HST2 and HST2-R in cracked and non-cracked concrete

			M8	M10	M12	M16
Steel failure						
HST2						
Characteristic resistance	$N_{Rk,s}$	[kN]	17,8	31,4	44,8	78,2
Partial safety factor	γ_{Ms} [1)]	[-]	1,40			
HST2-R						
Characteristic resistance	$N_{Rk,s}$	[kN]	17,6	30,5	43,1	78,2
Partial safety factor	γ_{Ms} [1)]	[-]	1,40			
Pullout failure						
HST2						
Characteristic resistance in cracked concrete C20/25	$N_{Rk,p}$	[kN]	5,0	9,0	12,0	20,0
Characteristic resistance in non-cracked concrete C20/25	$N_{Rk,p}$	[kN]	9,0	16,0	20,0	35,0
Installation safety factor	γ_{inst}	[-]	1,00			
HST2-R						
Characteristic resistance in cracked concrete C20/25	$N_{Rk,p}$	[kN]	5,0	9,0	12,0	25,0
Characteristic resistance in non-cracked concrete C20/25	$N_{Rk,p}$	[kN]	9,0	16,0	20,0	35,0
Installation safety factor	γ_{inst}	[-]	1,00			
HST2 and HST2-R						
Increasing factor for cracked and non-cracked concrete	ψ_C	C20/25	1,00			
	ψ_C	C30/37	1,22			
	ψ_C	C40/50	1,41			
	ψ_C	C50/60	1,55			

[1)] In absence of other national regulations

Hilti metal expansion anchor HST2 and HST2-R

Performances
Characteristic values of resistance under tension loading in cracked and non-cracked concrete

Annex C1

Deutsches Institut für Bautechnik DIBt

Table C1 continued

			M8	M10	M12	M16
Concrete cone and splitting failure						
HST2 and HST2-R						
Effective embedment depth	h_{ef}	[mm]	47	60	70	82
Installation safety factor	γ_{inst}	[-]	1,00			
Factor for cracked concrete	$k_1 = k_{cr,N}$	[-]	7,7			
Factor for non-cracked concrete	$k_1 = k_{ucr,N}$	[-]	11,0			
Spacing	$s_{cr,N}$ $s_{cr,sp}$	[mm]	3 h_{ef}			
Edge distance	$c_{cr,N}$ $c_{cr,sp}$	[mm]	1,5 h_{ef}			

Hilti metal expansion anchor HST2 and HST2-R

Performances
Characteristic values of resistance under tension loading in cracked and non-cracked concrete

Annex C2

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Table C2: Characteristic shear resistance for HST2 and HST2-R in cracked and non-cracked concrete

			M8	M10	M12	M16
Steel failure						
HST2						
Characteristic resistance	$V_{Rk,s}$	[kN]	11,4	21,6	31,4	55,3
Partial safety factor	γ_{Ms} [1)]	[-]	1,25			
Ductility factor	k_7	[-]	1,0			
HST2-R						
Characteristic resistance	$V_{Rk,s}$	[kN]	15,7	25,3	36,7	63,6
Partial safety factor	γ_{Ms} [1)]	[-]	1,25			
Ductility factor	k_7	[-]	1,0			
Steel failure with lever arm						
HST2						
Characteristic resistance	$M^0_{Rk,s}$	[Nm]	25	55	93	240
Partial safety factor	γ_{Ms} [1)]	[-]	1,25			
HST2-R						
Characteristic resistance	$M^0_{Rk,s}$	[Nm]	27	53	93	216
Partial safety factor	γ_{Ms} [1)]	[-]	1,25			
Concrete pryout failure						
HST2 and HST2-R						
Installation safety factor	γ_{inst}	[-]	1,0			
Pryout factor	k_8	[-]	2,0	2,0	2,2	2,5
Concrete edge failure						
HST2 and HST2-R						
Effective length of anchor in shear loading	l_f	[mm]	47	60	70	82
Diameter of anchor	d_{nom}	[mm]	8	10	12	16
Installation safety factor	γ_{inst}	[-]	1,0			

[1)] In absence of other national regulations

Hilti metal expansion anchor HST2 and HST2-R

Performances
Characteristic values of resistance under shear loading in cracked and non-cracked concrete

Annex C3

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Table C3: Displacements under tension and shear loads for HST2 and HST2-R for static and quasi static loading

			M8	M10	M12	M16
Displacements under tension loading						
HST2						
Tension load in cracked concrete	N	[kN]	2,0	4,3	5,7	9,5
Corresponding displacement	δ_{N0}	[mm]	1,3	0,2	0,1	0,5
	$\delta_{N\infty}$	[mm]	1,2	1,0	1,2	1,2
Tension load in non-cracked concrete	N	[kN]	3,6	7,6	9,5	16,7
Corresponding displacement	δ_{N0}	[mm]	0,2	0,1	0,1	0,4
	$\delta_{N\infty}$	[mm]	1,1	1,1	1,1	1,1
HST2-R						
Tension load in cracked concrete	N	[kN]	2,4	4,3	5,7	11,9
Corresponding displacement	δ_{N0}	[mm]	0,6	0,2	0,8	1,0
	$\delta_{N\infty}$	[mm]	1,5	1,2	1,4	1,2
Tension load in non-cracked concrete	N	[kN]	4,3	7,6	9,5	16,7
Corresponding displacement	δ_{N0}	[mm]	0,1	0,1	0,1	0,1
	$\delta_{N\infty}$	[mm]	1,5	1,2	1,4	1,2
Displacements under shear loading						
HST2						
Shear load in cracked and non-cracked concrete	V	[kN]	6,5	12,3	17,9	31,6
Corresponding displacement	δ_{V0}	[mm]	2,0	2,3	3,3	4,0
	$\delta_{V\infty}$	[mm]	3,1	3,4	4,9	6,0
HST2-R						
Shear load in cracked and non-cracked concrete	V	[kN]	9,0	14,5	21,0	36,3
Corresponding displacement	δ_{V0}	[mm]	1,9	4,3	6,0	2,9
	$\delta_{V\infty}$	[mm]	2,9	6,4	9,1	4,4

Hilti metal expansion anchor HST2 and HST2-R

Performances
Displacements under tension and shear loading

Annex C4

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Table C4: Characteristic tension resistance under fire exposure for HST2 and HST2-R in cracked and non-cracked concrete

				M8	M10	M12	M16
Steel failure							
HST2 and HST2-R							
Characteristic resistance	R30	$N_{Rk,s,fi}$	[kN]	0,9	2,5	5,0	9,0
	R60	$N_{Rk,s,fi}$	[kN]	0,7	1,5	3,5	6,0
	R90	$N_{Rk,s,fi}$	[kN]	0,6	1,0	2,0	3,5
	R120	$N_{Rk,s,fi}$	[kN]	0,5	0,7	1,0	2,0
Pullout failure							
HST2 and HST2-R							
Characteristic resistance in concrete ≥ C20/25	R30	$N_{Rk,p,fi}$	[kN]	1,3	2,3	3,0	5,0
	R60	$N_{Rk,p,fi}$	[kN]				
	R90	$N_{Rk,p,fi}$	[kN]				
	R120	$N_{Rk,p,fi}$	[kN]	1,0	1,8	2,4	4,0
Concrete cone failure							
HST2 and HST2-R							
Characteristic resistance in concrete ≥ C20/25	R30	$N^0_{Rk,c,fi}$	[kN]	2,7	5,0	7,4	11,0
	R60	$N^0_{Rk,c,fi}$	[kN]				
	R90	$N^0_{Rk,c,fi}$	[kN]				
	R120	$N^0_{Rk,c,fi}$	[kN]	2,2	4,0	5,9	8,8
Spacing		$s_{cr,N}$	[mm]	$4\ h_{ef}$			
		s_{min}	[mm]	50	55	60	80
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			

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 and HST2-R	**Annex C5**
Performances Characteristic values of resistance under tension loading under fire exposure in cracked and non-cracked concrete	

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Table C5: Characteristic shear resistance under fire exposure for HST2 and HST2-R in cracked and non-cracked concrete

				M8	M10	M12	M16
Steel failure without lever arm							
HST2 and HST2-R							
Characteristic resistance	R30	$V^0_{Rk,s,fi}$	[kN]	0,9	2,5	5,0	9,0
	R60	$V^0_{Rk,s,fi}$	[kN]	0,7	1,5	3,5	6,0
	R90	$V^0_{Rk,s,fi}$	[kN]	0,6	1,0	2,0	3,5
	R120	$V^0_{Rk,s,fi}$	[kN]	0,5	0,7	1,0	2,0
Steel failure with lever arm							
HST2 and HST2-R							
Characteristic resistance	R30	$M^0_{Rk,s,fi}$	[Nm]	1,0	3,3	8,1	20,6
	R60	$M^0_{Rk,s,fi}$	[Nm]	0,8	2,4	5,7	14,4
	R90	$M^0_{Rk,s,fi}$	[Nm]	0,7	1,6	3,2	8,2
	R120	$M^0_{Rk,s,fi}$	[Nm]	0,6	1,2	2,0	5,1
Concrete pryout failure							
HST2 and HST2-R							
Pryout factor		k_8	[-]	2,00	2,00	2,20	2,50
Characteristic resistance in concrete ≥ C20/25	R30	$V^0_{Rk,cp,fi}$	[kN]	5,4	10,0	16,0	27,2
	R60	$V^0_{Rk,cp,fi}$	[kN]				
	R90	$V^0_{Rk,cp,fi}$	[kN]				
	R120	$V^0_{Rk,cp,fi}$	[kN]	4,4	8,0	12,9	21,7
Concrete edge failure							
HST2 and HST2-R							
The initial value $V^0_{Rk,c,fi}$ of the characteristic resistance in concrete C20/25 to C50/60 under fire exposure may be determined by: $V^0_{Rk,c,fi} = 0,25 \times V^0_{Rk,c}$ (≤ 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 in cracked concrete C20/25 under normal 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 and HST2-R	**Annex C6**
Performances Characteristic values of resistance under shear loading under fire exposure in cracked and non-cracked concrete	