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-98/0001 of 6 November 2015

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 HST, HST-R, HST-HCR, HST3, HST3-R
Product family to which the construction product belongs	Torque controlled expansion anchor of sizes M8, M10, M12, M16, M20 and M24 for use in concrete
Manufacturer	Hilti Aktiengesellschaft Business Unit Anchors 9494 Schaan FÜRSTENTUM LIECHTENSTEIN
Manufacturing plant	Hilti Werke
This European Technical Assessment contains	58 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.

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Specific Part

1 Technical description of the product

The Hilti metal expansion anchor HST and HST3 is an anchor made of galvanized steel (HST, HST3), stainless steel (HST-R, HST3-R) or high corrosion resistant steel (HST-HCR) 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 C11
Characteristic resistance for seismic performance category C1, displacements	See Annex C12 to C15
Characteristic resistance for seismic performance category C2, displacements	See Annex C16 to C19

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 C20 to C29

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 6 November 2015 by Deutsches Institut für Bautechnik

Uwe Bender
Head of Department

beglaubigt:
Gerhart Lange

Deutsches Institut für Bautechnik

Installed condition

Figure A1:

Hilti metal expansion anchor HST, HST-R and HST-HCR

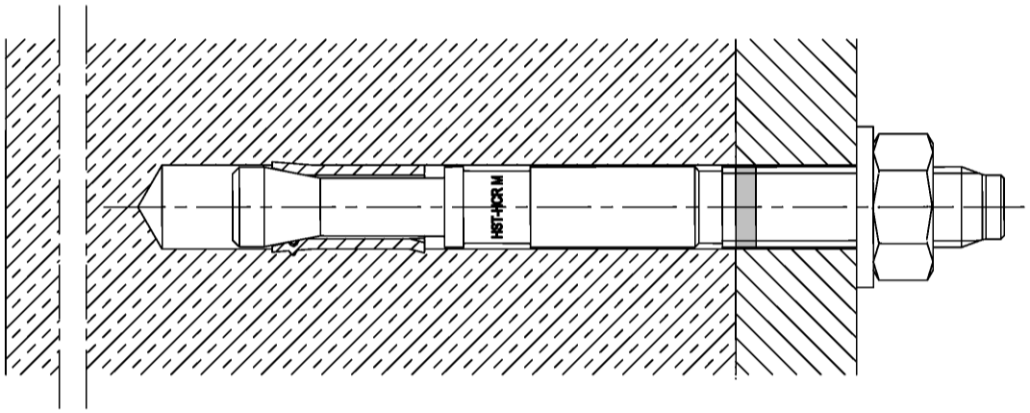
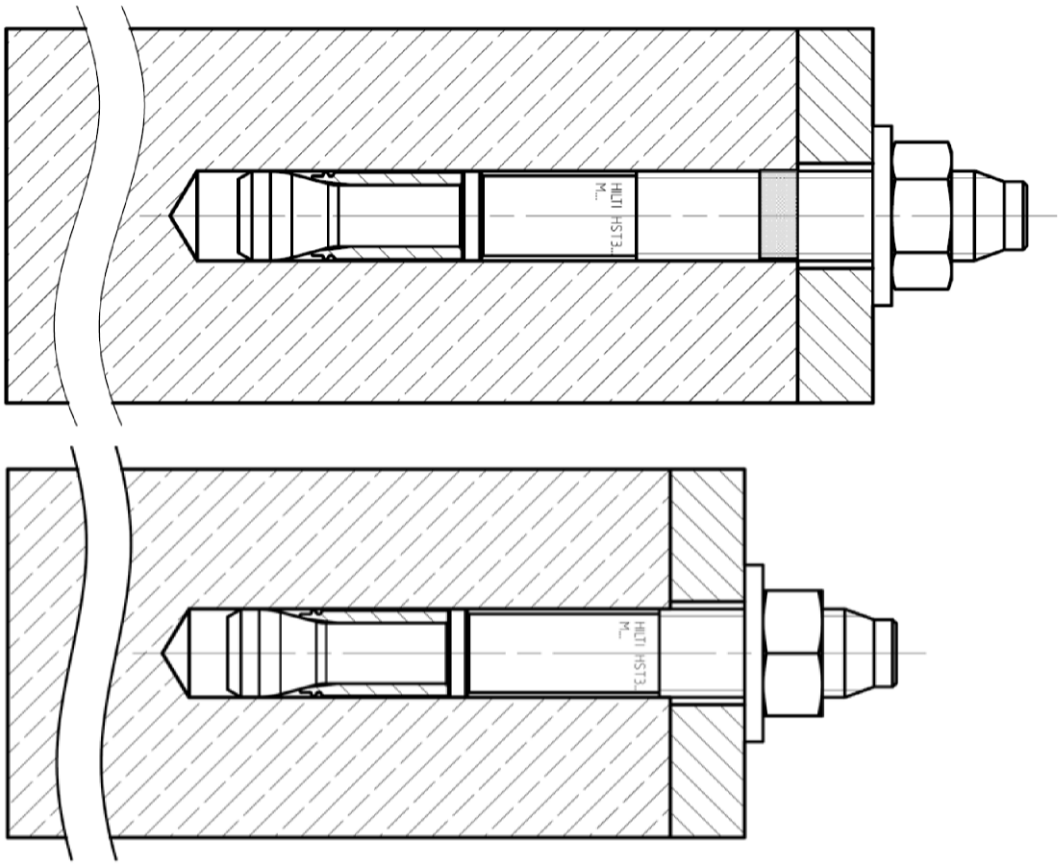


Figure A2:

Hilti metal expansion anchor HST3 and HST3-R with standard and shallow embedment depth



Hilti metal expansion anchor HST, HST-R, HST-HCR, HST3, HST3-R	
Product description Installed condition	**Annex A1**

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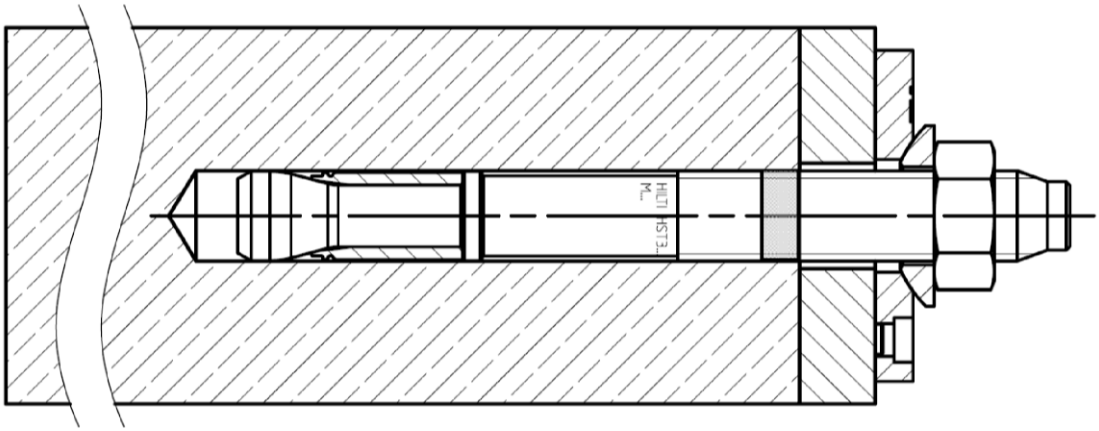
Figure A3:
Hilti metal expansion anchor HST3 and HST3-R with Seismic/Filling Set



Hilti metal expansion anchor HST, HST-R, HST-HCR, HST3, HST3-R	**Annex A2**
Product description Installed condition	

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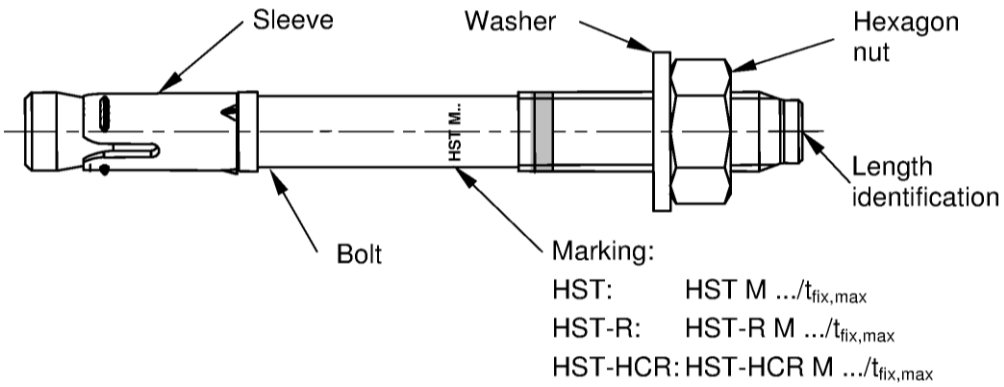
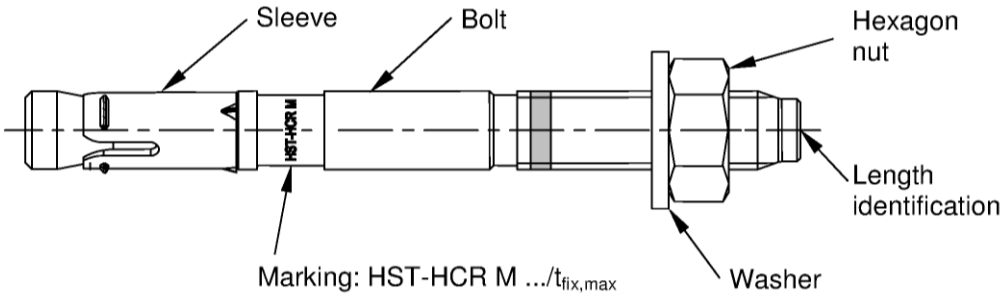
Product description: Hilti metal expansion anchor HST, HST-R and HST-HCR

Cold-formed version



Machined version



Hilti metal expansion anchor HST, HST-R, HST-HCR, HST3, HST3-R	Annex A3
Product description Anchor types, marking and identification after installation	

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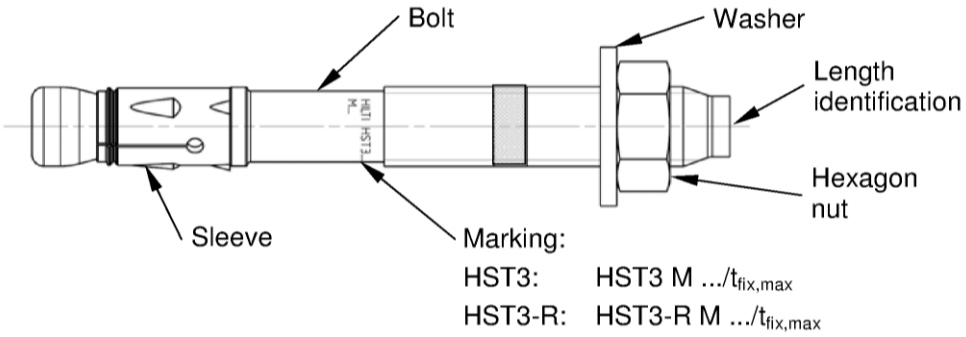
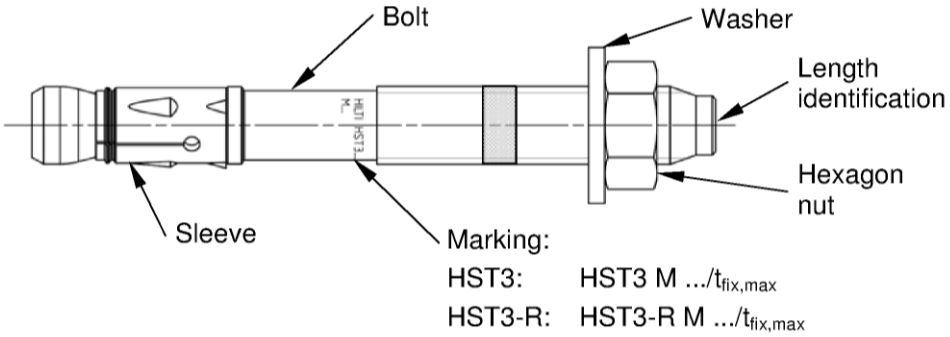
Product description: Hilti metal expansion anchor HST3 and HST3-R

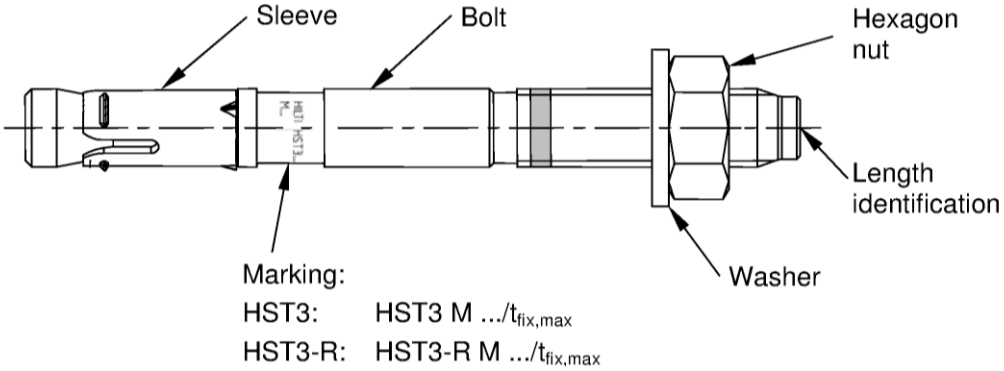
Cold-formed version



Machined version M8 - M16



Machined version M20 - M24



Hilti metal expansion anchor HST, HST-R, HST-HCR, HST3, HST3-R	**Annex A4**
Product description Anchor types, marking and identification after installation	

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Table A1: Length identification HST, HST3, HST-R, HST3-R, HST-HCR

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 HST, HST-R, HST-HCR, HST3, HST3-R

Product description
Anchor types, marking and identification after installation

Annex A5

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Table A2: Materials

Designation	Material
HST (Carbon steel)	
Expansion sleeve	Stainless steel A4
Bolt	Galvanized, EN ISO 4042:1999, coated (transparent)
Washer	Galvanized, EN ISO 4042:1999
Hexagon nut	Strength class 8, EN ISO 20898-2:2012
HST-R (Stainless steel)	
Expansion sleeve	Stainless steel A4
Bolt	Stainless steel A4, cone coated (red or transparent)
Washer	Stainless steel A4
Hexagon nut	Stainless steel A4, coated
HST-HCR (High corrosion resistance steel)	
Expansion sleeve	Stainless steel A4
Bolt	High corrosion resistance steel, cone coated (red)
Washer	High corrosion resistance steel
Hexagon nut	High corrosion resistance steel, coated

Hilti metal expansion anchor HST, HST-R, HST-HCR, HST3, HST3-R	**Annex A6**
Product description Materials	

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Table A2 continued

Designation	Material
HST3 (Carbon steel)	
Expansion sleeve	M10, M16: Galvanized, EN ISO 4042:1999 or stainless steel M8, M12, M20, M24: Stainless steel
Bolt	Galvanized, EN ISO 4042:1999, coated (transparent)
Washer	Galvanized, EN ISO 4042:1999
Hexagon nut	Strength class 8, EN ISO 20898-2:2012
Seismic/Filling Set (Carbon steel)	
Sealing washer	Galvanized, EN ISO 4042:1999
Spherical washer	Galvanized, EN ISO 4042:1999
HST3-R (Stainless steel)	
Expansion sleeve	Stainless steel A4
Bolt	Stainless steel A4, cone coated (transparent)
Washer	Stainless steel A4
Hexagon nut	Stainless steel A4, coated
Seismic/Filling Set (Stainless steel)	
Sealing washer	Stainless steel A4
Spherical washer	Stainless steel A4

Hilti metal expansion anchor HST, HST-R, HST-HCR, HST3, HST3-R

Product description
Materials

Annex A7

Deutsches Institut für Bautechnik DIBt

Injection mortar Hilti HIT-HY 200-A

Hybrid system with resin, hardener, cement and water components
Foil pack 330 ml and 500 ml

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

Product name: "Hilti HIT-HY 200-A"

Static mixer Hilti HIT-RE-M

Dispensers

Hilti HDM 330

Hilti HDE 500

Table A3: curing time Hilti HIT-HY 200-A

Temperature of base material / environment	Curing time t_{cure} Hilti HIT-HY 200-A
-10 °C to -5 °C	7 hours
-4 °C to 0 °C	4 hours
1 °C to 5 °C	2 hours
6 °C to 10 °C	75 minutes
11 °C to 20 °C	45 minutes
21 °C to 30 °C	30 minutes
31 °C to 40 °C	30 minutes

Hilti metal expansion anchor HST, HST-R, HST-HCR, HST3, HST3-R	**Annex A8**
Product description Injection mortar	

Dimensions

HST, HST-R and HST-HCR

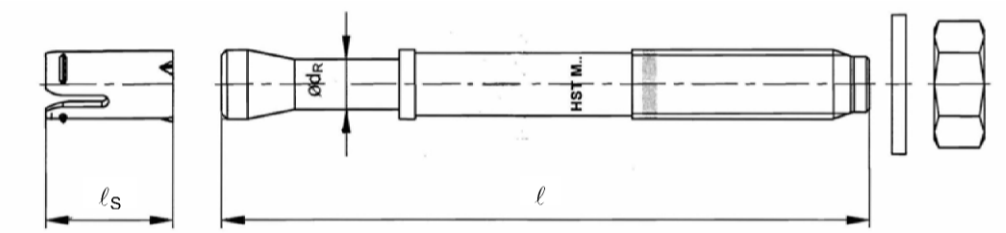

Table A4: Dimensions HST, HST-R and HST-HCR

HST, HST-R, HST-HCR			M8	M10	M12	M16	M20 [1]	M24 [1]
Maximum length of anchor	$\ell_{max} \leq$	[mm]	260	280	295	350	450	500
Shaft diameter at the cone	d_R	[mm]	5,5	7,2	8,5	11,6	14,6	17,4
Length of expansion sleeve	ℓ_S	[mm]	14,8	18,2	22,7	24,3	28,3	36,0

[1] Only HST and HST-R

HST3 and HST-R

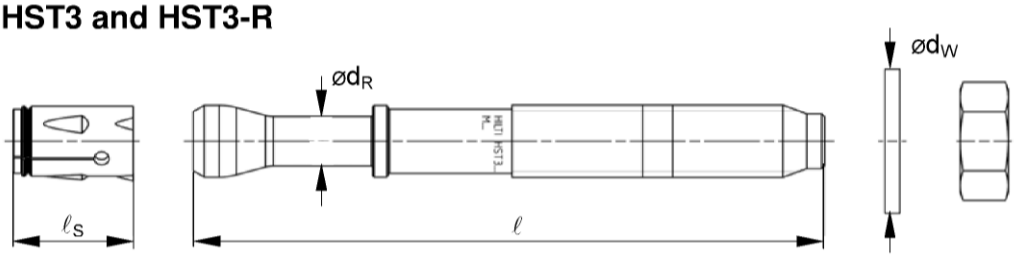

Table A5: Dimensions HST3 and HST3-R

HST3, HST3-R			M8	M10	M12	M16	M20	M24
Maximum length of anchor	$\ell_{max} \leq$	[mm]	260	280	350	475	450	500
Shaft diameter at the cone	d_R	[mm]	5,60	6,94	8,22	11,00	14,62	17,4
Length of expansion sleeve	ℓ_S	[mm]	13,6	16,0	20,0	25,0	28,3	36,0
Diameter of washer	$d_W \geq$	[mm]	15,57	19,48	23,48	29,48	36,38	43,38

Seismic/Filling Set to fill the annular gap between anchor and fixture

Sealing washer

Spherical washer

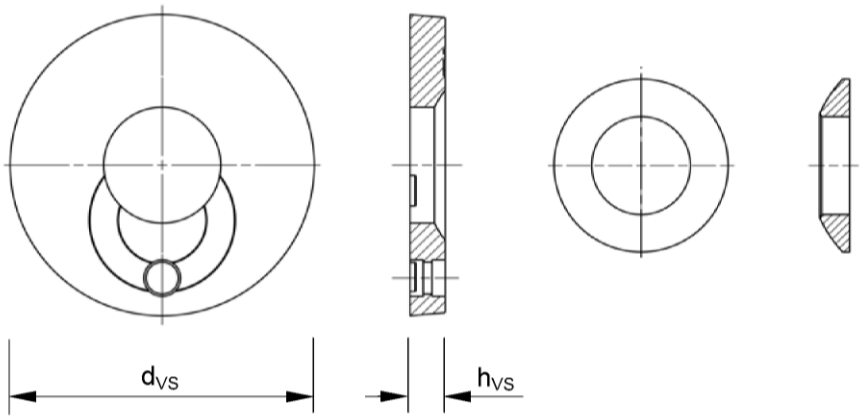

Table A6: Dimensions Seismic/Filling Set

Seismic/Filling Set used for HST3, HST3-R			M8	M10	M12	M16	M20
Diameter of sealing washer	d_{VS}	[mm]	38	42	44	52	60
Thickness of sealing washer	h_{VS}	[mm]	5			6	

Hilti metal expansion anchor HST, HST-R, HST-HCR, HST3, HST3-R

Product description
Dimensions

Annex A10

Deutsches Institut für Bautechnik DIBt

Specifications of intended use

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
- Cracked and non-cracked concrete

Use conditions (Environmental conditions):

- Hilti metal expansion anchor HST and HST3 made of galvanized steel:
  Structures subject to dry internal conditions
- Hilti metal expansion anchor HST-R and HST3-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).
- Hilti metal expansion anchor HST-HCR made of high corrosion resistance steel:
  Structures subject to dry internal conditions and also in structures subject to external atmospheric exposure, in permanently damp internal conditions or in other particular aggressive conditions. 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 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:
  ETAG 001, Annex C, design method A, Edition August 2013 or
  CEN/TS 1992-4:2009, design method A
- Anchorages under seismic actions (cracked concrete) are designed in accordance with:
  EOTA Technical Report TR 045, Edition February 2013
- Anchorages under fire exposure are designed in accordance with:
  EOTA Technical Report TR 020, Edition May 2004
  CEN/TS 1992-4:2009, Annex D

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 HST, HST-R, HST-HCR, HST3, HST3-R	**Annex B1**
Specifications of intended use	

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Table B1: Overview use categories and performance categories

Anchorages subject to:	**HST, HST-R, HST-HCR**
	Metal expansion anchor
Hammer drilling	M8 to M24
Static and quasi static loading	M8 to M24 (HST and HST-R) M8 to M16 (HST-HCR) Table : C1, C3, C5
Seismic performance category C1/C2	M10 to M16 (HST and HST-R) Table : C7, C9, C11, C12, C15, C16
Static and quasi static loading under fire exposure	M8 to M24 Table : C19, C21

Anchorages subject to:	**HST3, HST3-R**
	Metal expansion anchor
Hammer drilling	M8 to M24
Hollow drill bit drilling 	M12 to M24
Diamond core drilling  DD EC-1 tool DD 30-W tool	 M8 to M24 M8 to M24
Static and quasi static loading	M10 to M16 (for $h_{ef,1}$) M8 to M24 (for $h_{ef,2}$) Table : C2, C4, C6
Seismic performance category C1/C2	M8 to M20 (for $h_{ef,2}$) Table : C8, C10, C13, C14, C17, C18
Static and quasi static loading under fire exposure	M10 to M16 (for $h_{ef,1}$) M8 to M24 (for $h_{ef,2}$) Table : C20, C22

Hilti metal expansion anchor HST, HST-R, HST-HCR, HST3, HST3-R	**Annex B2**
Specifications of intended use	

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Table B2: Installation parameters for HST, HST-R and HST-HCR

HST, HST-R, HST-HCR			M8	M10	M12	M16	M20 [1)]	M24 [1)]
Nominal diameter of drill bit	d_0	[mm]	8	10	12	16	20	24
Cutting diameter of drill bit	$d_{cut} \leq$	[mm]	8,45	10,45	12,50	16,50	20,55	24,55
Drill hole depth	$h_1 \geq$	[mm]	65	80	95	115	140	170
Effective embedment depth	h_{ef}	[mm]	47	60	70	82	101	125
Thread engagement length	h_{nom}	[mm]	55	69	80	95	117	143
Maximum diameter of clearance hole in the fixture	d_f	[mm]	9	12	14	18	22	26
Installation torque moment	T_{inst}	[Nm]	20	45	60	110	240	300
Maximum thickness of fixture	$t_{fix,max} \leq$	[mm]	195	200	200	235	305	330
Width across flats	S_w	[mm]	13	17	19	24	30	36

[1)] Only HST and HST-R

Hilti metal expansion anchor HST, HST-R, HST-HCR, HST3, HST3-R

Intended use
Installation parameters

Annex B3

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Table B3: Installation parameters for HST3 and HST3-R

HST3, HST3-R			M8	M10	M12	M16	M20	M24
Nominal diameter of drill bit	d_0	[mm]	8	10	12	16	20	24
Cutting diameter of drill bit for hammer drilling	$d_{cut} \leq$	[mm]	8,45	10,45	12,50	16,50	20,55	24,55
Hollow drill bit			-	-	TE-CD … TE-YD …			
Diamond core drill bit			DD-C … TS DD-C … TL					
Drill hole depth [1)]	$h_{1,1} \geq$	[mm]	-	53	68	86	-	-
Effective embedment depth	$h_{ef,1}$	[mm]	-	40	50	65	-	-
Thread engagement length	$h_{nom,1}$	[mm]	-	48	60	78	-	-
Drill hole depth [1)]	$h_{1,2} \geq$	[mm]	59	73	88	106	124	151
Effective embedment depth	$h_{ef,2}$	[mm]	47	60	70	85	101	125
Thread engagement length	$h_{nom,2}$	[mm]	54	68	80	98	116	143
Maximum diameter of clearance hole in the fixture	d_f	[mm]	9	12	14	18	22	26
Installation torque moment	T_{inst}	[Nm]	20	45	60	110	180	300
Maximum thickness of fixture	$t_{fix,max}$	[mm]	195	220	270	370	310	330
Width across flats	S_w	[mm]	13	17	19	24	30	36

[1)] In case of diamond drilling + 5 mm for M8 to M10 and + 2 mm for M12 to M24

Hilti metal expansion anchor HST, HST-R, HST-HCR, HST3, HST3-R

Intended use
Installation parameters

Annex B4

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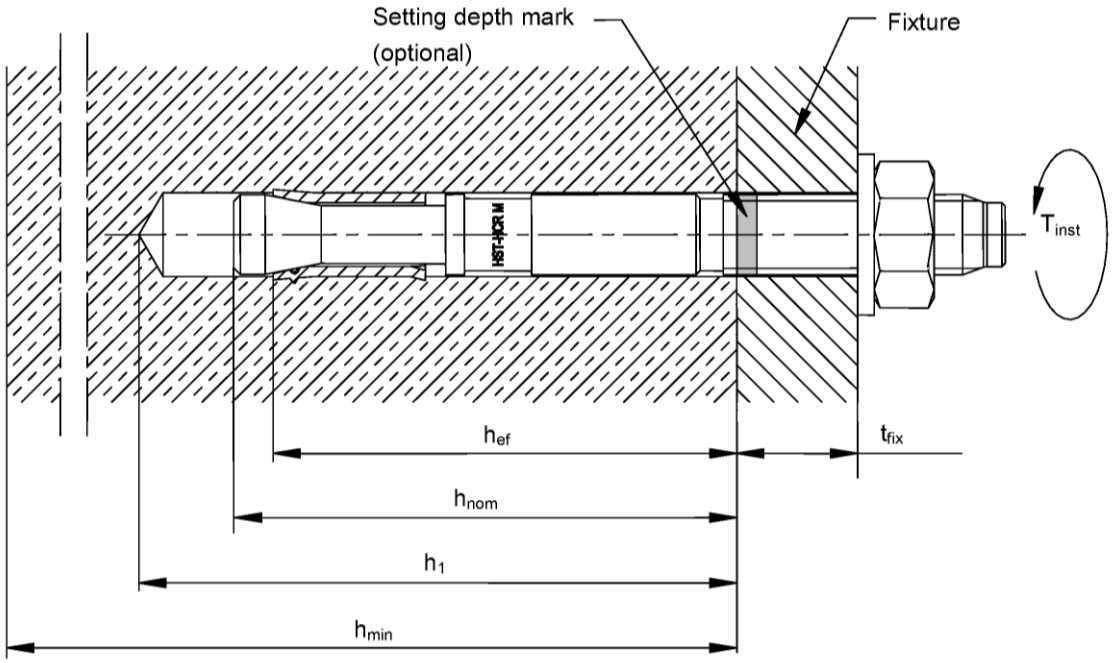
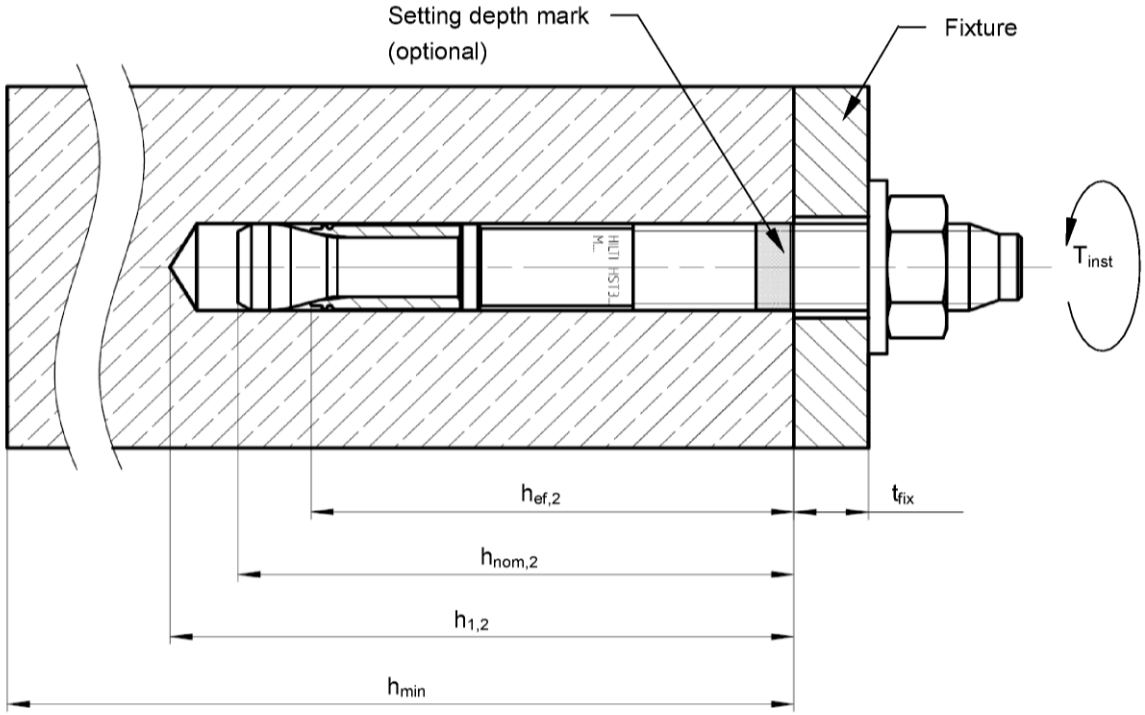
HST, HST-R and HST-HCR



HST3 and HST3-R (standard embedment depth)



Hilti metal expansion anchor HST, HST-R, HST-HCR, HST3, HST3-R

Intended Use
Installation parameters

Annex B5

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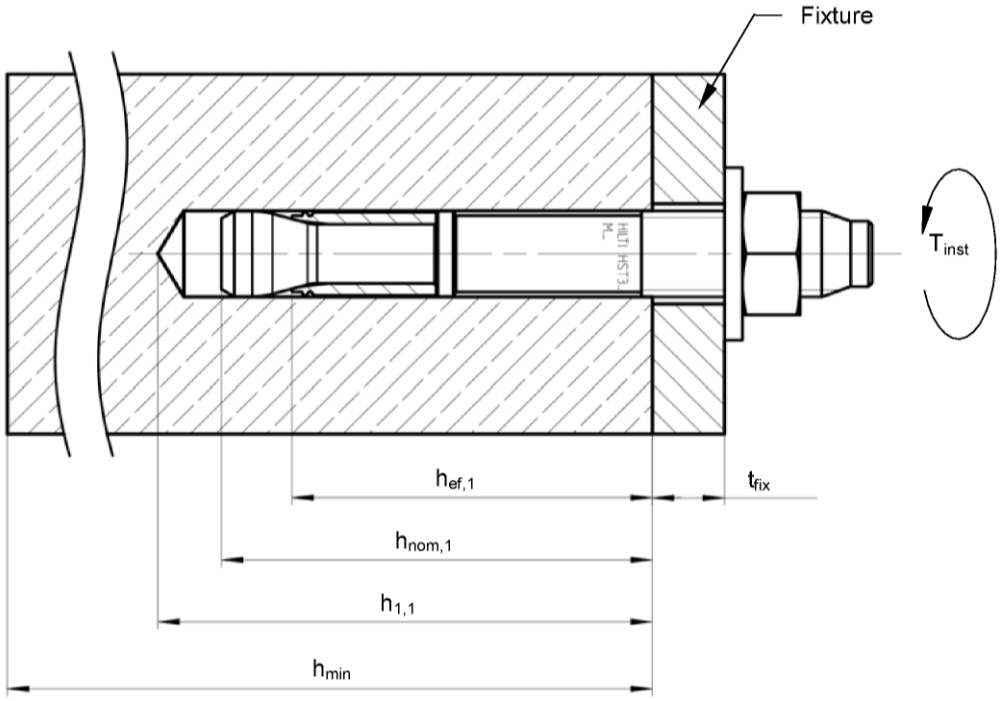
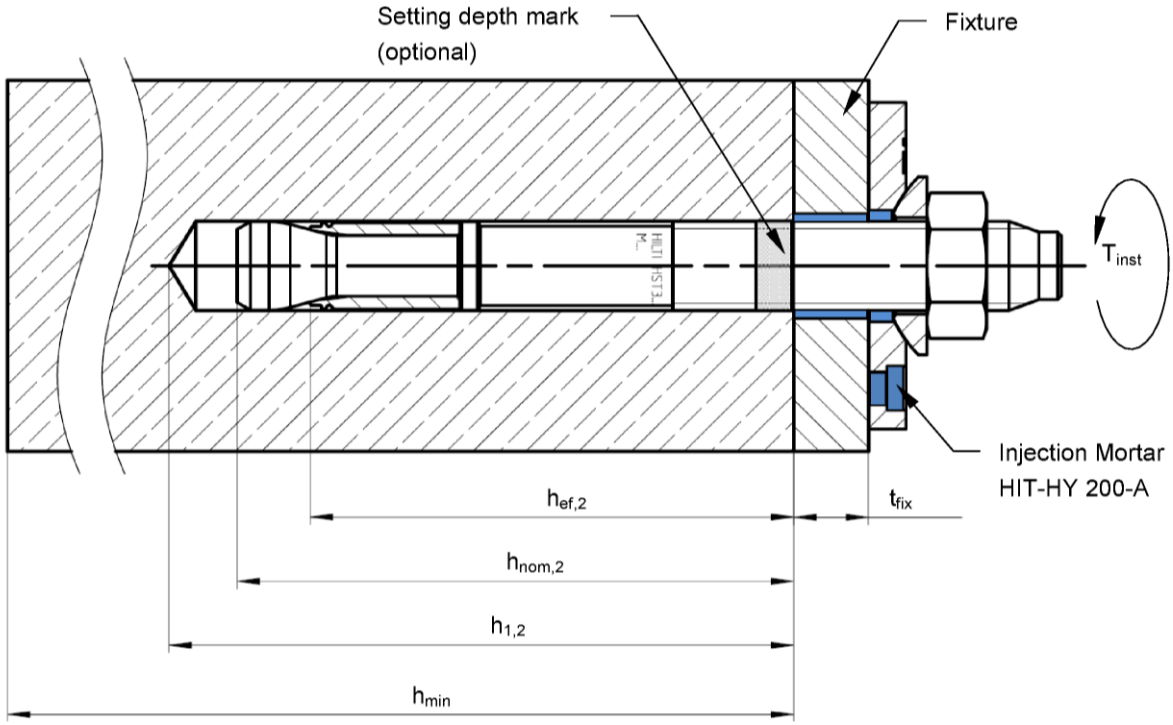
HST3 and HST3-R (shallow embedment depth)



HST3 and HST3-R with Seismic/Filling Set to fill the annular gap between anchor and fixture



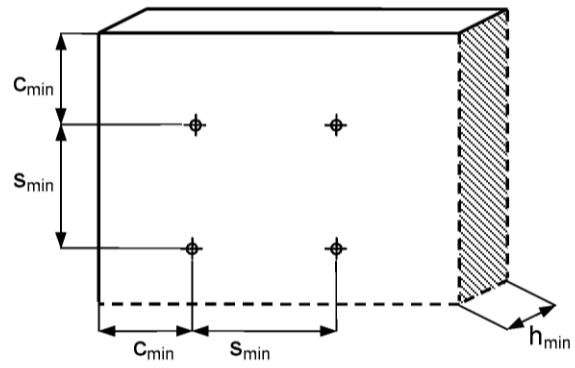
Hilti metal expansion anchor HST, HST-R, HST-HCR, HST3, HST3-R	
Intended Use Installation parameters	**Annex B6**

Table B4: Minimum spacing and edge distance for HST, HST-R and HST-HCR

			M8	M10	M12	M16	M20 [1]	M24 [1]
Minimum thickness of concrete member	h_{min}	[mm]	100	120	140	160	200	250
Effective embedment depth	h_{ef}	[mm]	47	60	70	82	101	125
Cracked concrete								
HST								
Minimum spacing [2]	s_{min}	[mm]	40	55	60	70	100	125
	for c ≥	[mm]	50	70	75	100	160	180
Minimum edge distance [2]	c_{min}	[mm]	45	55	55	70	100	125
	for s ≥	[mm]	50	90	120	150	225	240
HST-R								
Minimum spacing [2]	s_{min}	[mm]	40	55	60	70	100	125
	for c ≥	[mm]	50	65	75	100	130	130
Minimum edge distance [2]	c_{min}	[mm]	45	50	55	60	100	125
	for s ≥	[mm]	50	90	110	160	160	140
HST-HCR								
Minimum spacing [2]	s_{min}	[mm]	40	55	60	70	-	-
	for c ≥	[mm]	50	70	75	100	-	-
Minimum edge distance [2]	c_{min}	[mm]	45	50	55	60	-	-
	for s ≥	[mm]	50	90	110	160	-	-

[1] Only HST and HST-R

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



Hilti metal expansion anchor HST, HST-R, HST-HCR, HST3, HST3-R

Intended Use
Minimum spacing and minimum edge distance

Annex B7

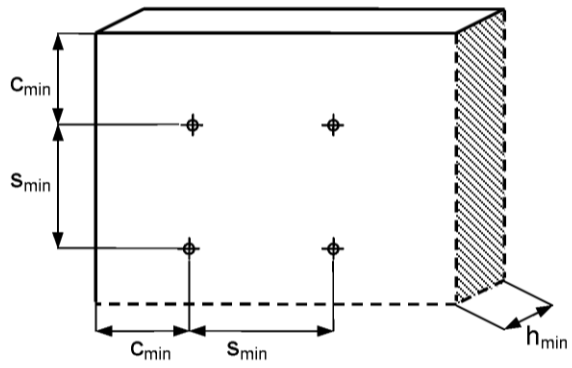
Deutsches Institut für Bautechnik DIBt

Table B4 continued

			M8	M10	M12	M16	M20 [1]	M24 [1]
Minimum thickness of concrete member	h_{min}	[mm]	100	120	140	160	200	250
Effective embedment depth	h_{ef}	[mm]	47	60	70	82	101	125
Non-cracked concrete								
HST								
Minimum spacing [2]	s_{min}	[mm]	60	55	60	70	100	125
	for c ≥	[mm]	50	80	85	110	225	255
Minimum edge distance [2]	c_{min}	[mm]	50	55	55	85	140	170
	for s ≥	[mm]	60	115	145	150	270	295
HST-R								
Minimum spacing [2]	s_{min}	[mm]	60	55	60	70	100	125
	for c ≥	[mm]	60	70	80	110	195	205
Minimum edge distance [2]	c_{min}	[mm]	60	50	55	70	140	150
	for s ≥	[mm]	60	115	145	160	210	235
HST-HCR								
Minimum spacing [2]	s_{min}	[mm]	60	55	60	70	-	-
	for c ≥	[mm]	50	70	80	110	-	-
Minimum edge distance [2]	c_{min}	[mm]	60	55	55	70	-	-
	for s ≥	[mm]	60	115	145	160	-	-

[1] Only HST and HST-R

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



Hilti metal expansion anchor HST, HST-R, HST-HCR, HST3, HST3-R

Intended Use
Minimum spacing and minimum edge distance

Annex B8

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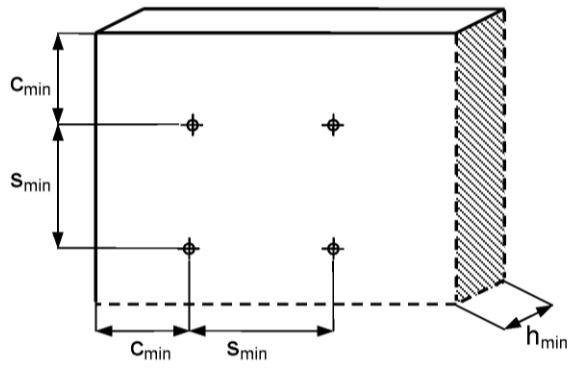
Table B5: Minimum spacing and edge distance for HST3 and HST3-R

			M8	M10	M12	M16	M20	M24
Minimum thickness of concrete member	h_{min}	[mm]	100	120	140	160	200	250
Effective embedment depth	$h_{ef,2}$	[mm]	47	60	70	85	101	125
Cracked concrete								
HST3								
Minimum spacing [1)]	s_{min}	[mm]	35	40	50	65	90	125
	for c ≥	[mm]	50	55	70	95	130	180
Minimum edge distance [1)]	c_{min}	[mm]	40	45	55	65	80	125
	for s ≥	[mm]	50	80	110	150	180	240
HST3-R								
Minimum spacing [1)]	s_{min}	[mm]	35	40	50	65	90	125
	for c ≥	[mm]	50	55	70	95	130	130
Minimum edge distance [1)]	c_{min}	[mm]	40	45	55	65	80	125
	for s ≥	[mm]	50	80	110	150	180	140

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



Hilti metal expansion anchor HST, HST-R, HST-HCR, HST3, HST3-R

Intended Use
Minimum spacing and minimum edge distance

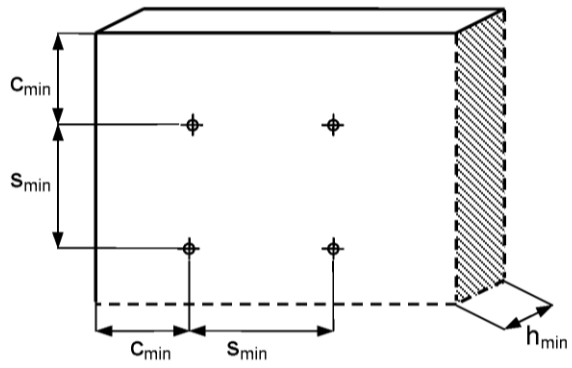
Annex B9

Deutsches Institut für Bautechnik DIBt

Table B5 continued

			M8	M10	M12	M16	M20	M24
Minimum thickness of concrete member	h_{min}	[mm]	100	120	140	160	200	250
Effective embedment depth	$h_{ef,2}$	[mm]	47	60	70	85	101	125
Non-cracked concrete								
HST3								
Minimum spacing [1)]	s_{min}	[mm]	35	40	60	65	90	125
	for c ≥	[mm]	50	60	70	95	130	255
Minimum edge distance [1)]	c_{min}	[mm]	40	50	55	65	80	170
	for s ≥	[mm]	50	90	110	150	180	295
HST3-R								
Minimum spacing [1)]	s_{min}	[mm]	35	40	60	65	90	125
	for c ≥	[mm]	50	60	70	95	130	205
Minimum edge distance [1)]	c_{min}	[mm]	40	50	55	65	80	150
	for s ≥	[mm]	50	90	110	150	180	235

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



Hilti metal expansion anchor HST, HST-R, HST-HCR, HST3, HST3-R

Intended Use
Minimum spacing and minimum edge distance

Annex B10

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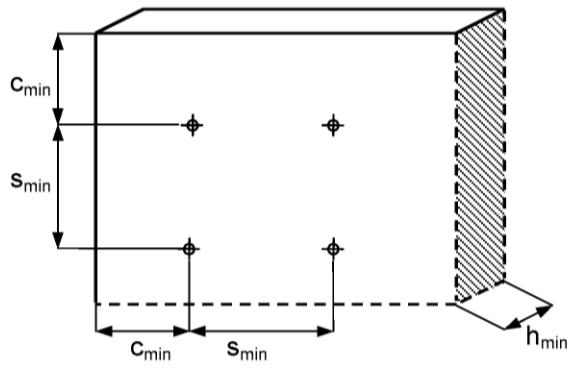
Table B5 continued

			M8	M10	M12	M16	M20	M24
Minimum thickness of concrete member	h_{min}	[mm]	80	100	120	140	160	-
Effective embedment depth	$h_{ef,2}$	[mm]	47	60	70	85	101	-
Cracked concrete								
HST3 and HST3-R								
Minimum spacing [1)]	s_{min}	[mm]	35	40	50	80	120	-
	for c ≥	[mm]	50	100	90	130	180	-
Minimum edge distance [1)]	c_{min}	[mm]	40	60	60	65	120	-
	for s ≥	[mm]	50	90	120	180	180	-
Non-cracked concrete								
HST3 and HST3-R								
Minimum spacing [1)]	s_{min}	[mm]	35	40	50	80	120	-
	for c ≥	[mm]	55	100	100	130	180	-
Minimum edge distance [1)]	c_{min}	[mm]	40	60	60	65	120	-
	for s ≥	[mm]	60	90	120	180	180	-

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



Hilti metal expansion anchor HST, HST-R, HST-HCR, HST3, HST3-R

Intended Use
Minimum spacing and minimum edge distance

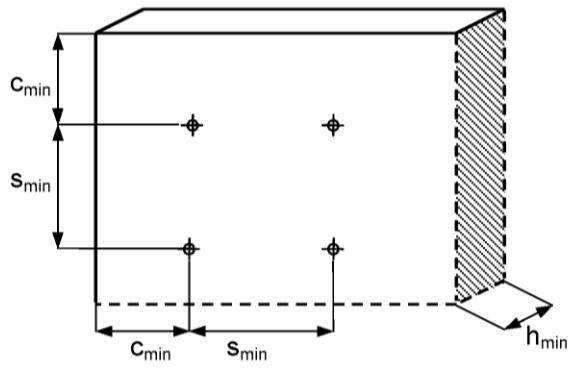
Annex B11

Deutsches Institut für Bautechnik DIBt

Table B5 continued

			M8	M10	M12	M16	M20	M24
Minimum thickness of concrete member	h_{min}	[mm]	-	80	100	120	-	-
Effective embedment depth	$h_{ef,1}$	[mm]	-	40	50	65	-	-
Cracked concrete								
HST3 and HST3-R								
Minimum spacing [1)]	s_{min}	[mm]	-	40	50	65	-	-
	for c ≥	[mm]	-	90	105	130	-	-
Minimum edge distance [1)]	c_{min}	[mm]	-	45	55	65	-	-
	for s ≥	[mm]	-	180	210	240	-	-
Non-cracked concrete								
HST3 and HST3-R								
Minimum spacing [1)]	s_{min}	[mm]	-	50	55	75	-	-
	for c ≥	[mm]	-	95	110	140	-	-
Minimum edge distance [1)]	c_{min}	[mm]	-	50	60	65	-	-
	for s ≥	[mm]	-	190	215	240	-	-

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



Hilti metal expansion anchor HST, HST-R, HST-HCR, HST3, HST3-R

Intended Use
Minimum spacing and minimum edge distance

Annex B12

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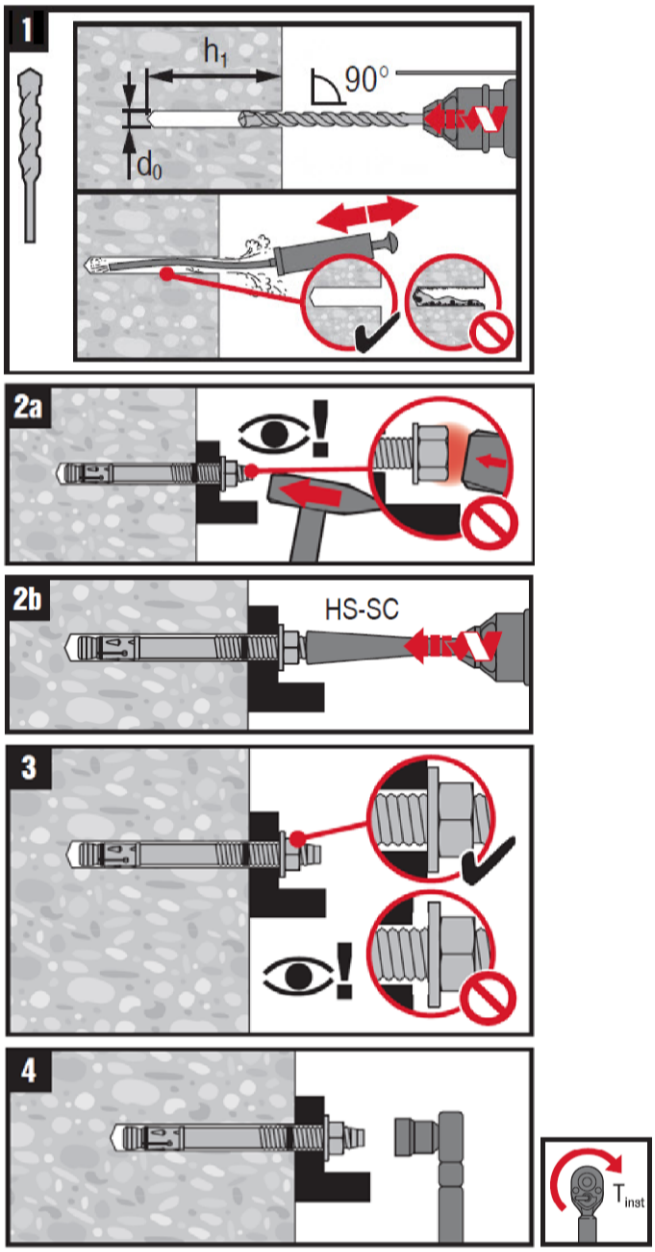
Installation instruction HST, HST-R and HST-HCR



Hilti metal expansion anchor HST, HST-R, HST-HCR, HST3, HST3-R	Annex B13
Intended Use Installation instructions	

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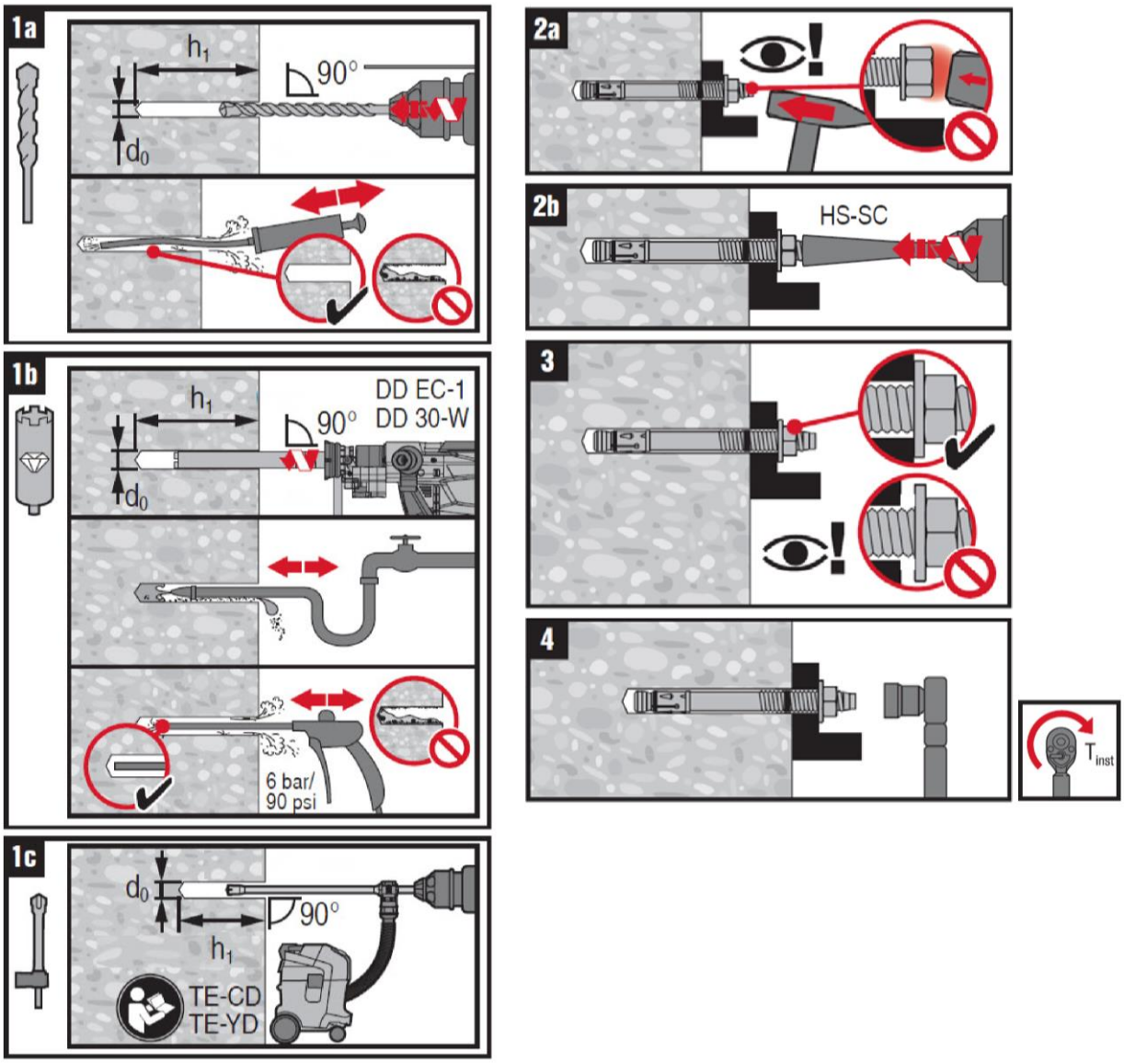
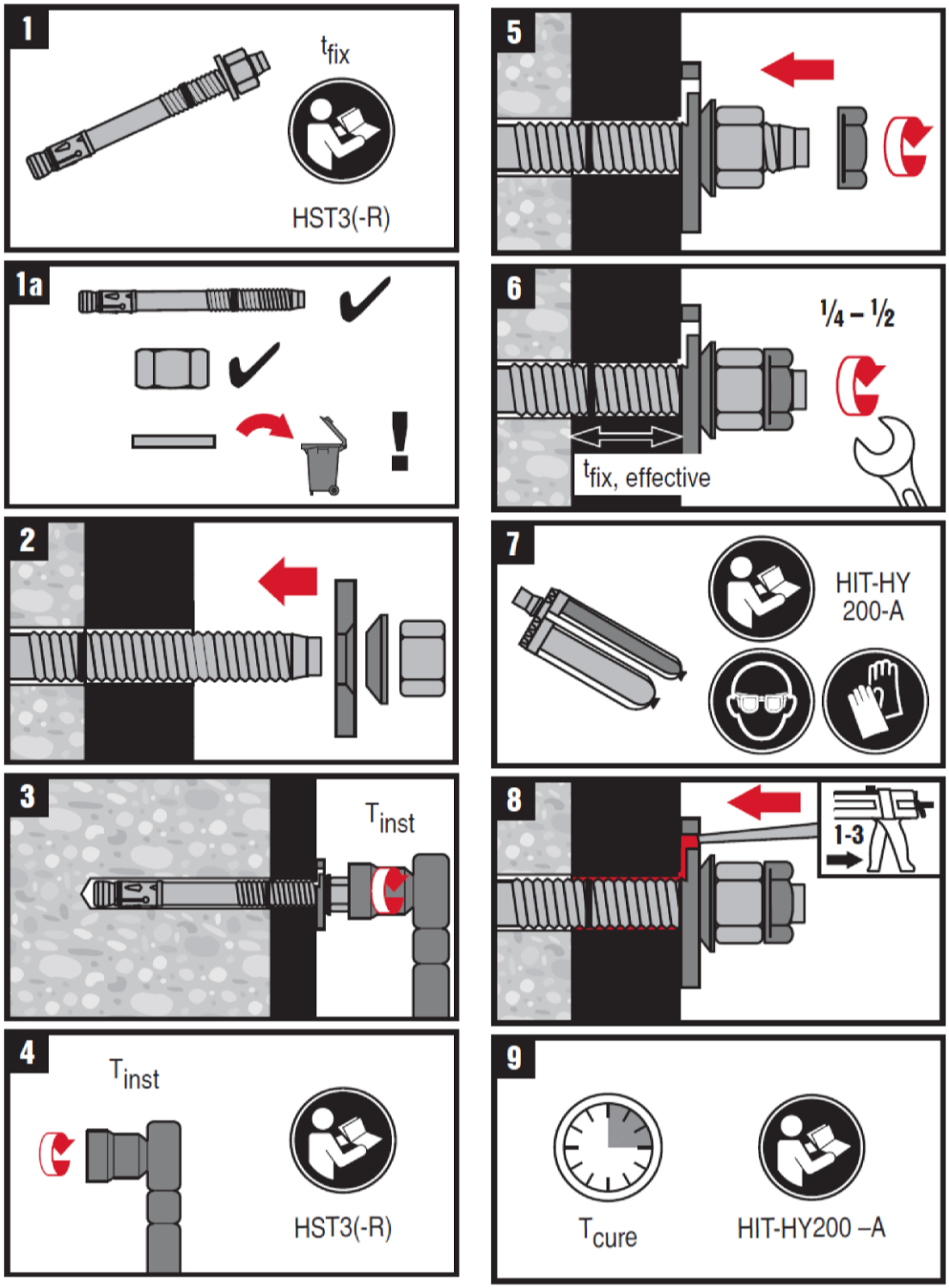
Installation instruction HST3 and HST3-R



Hilti metal expansion anchor HST, HST-R, HST-HCR, HST3, HST3-R	Annex B14
Intended Use Installation instructions	

Deutsches Institut für Bautechnik DIBt

Installation instruction HST3 and HST3-R with Seismic/Filling Set



Hilti metal expansion anchor HST, HST-R, HST-HCR, HST3, HST3-R	Annex B15
Intended Use Installation instructions	

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Table C1: Characteristic tension resistance for Hilti metal expansion anchor HST, HST-R and HST-HCR in cracked and non-cracked concrete

			M8	M10	M12	M16	M20 [1]	M24 [1]
Steel failure								
HST								
Characteristic resistance	$N_{Rk,s}$	[kN]	19	32	45	76	117	127
Partial safety factor	γ_{Ms} [2]	[-]	1,50					1,41
HST-R								
Characteristic resistance	$N_{Rk,s}$	[kN]	17	28	40	69	109	156
Partial safety factor	γ_{Ms} [2]	[-]	1,50			1,56	1,73	
HST-HCR								
Characteristic resistance	$N_{Rk,s}$	[kN]	19,4	32,3	45,7	84,5	-	-
Partial safety factor	γ_{Ms} [2]	[-]	1,50				-	-
Pullout failure								
HST								
Characteristic resistance in cracked concrete C20/25	$N_{Rk,p}$	[kN]	5	9	12	20	30	40
Characteristic resistance in non-cracked concrete C20/25	$N_{Rk,p}$	[kN]	9	16	20	35	50	60
Partial safety factor	$\gamma_2 = \gamma_{inst}$	[-]	1,20	1,00				
HST-R								
Characteristic resistance in cracked concrete C20/25	$N_{Rk,p}$	[kN]	5	9	12	25	30	40
Characteristic resistance in non-cracked concrete C20/25	$N_{Rk,p}$	[kN]	9	16	20	35	50	60
Partial safety factor	$\gamma_2 = \gamma_{inst}$	[-]	1,00					
HST-HCR								
Characteristic resistance in cracked concrete C20/25	$N_{Rk,p}$	[kN]	5	9	12	25	-	-
Characteristic resistance in cracked concrete C50/60	$N_{Rk,p}$	[kN]	9	16	20	35	-	-
Partial safety factor	$\gamma_2 = \gamma_{inst}$	[-]	1,00				-	-

[1] Only HST and HST-R

[2] In absence of other national regulations

Hilti metal expansion anchor HST, HST-R, HST-HCR, HST3, HST3-R

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

Annex C1

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Table C1 continued

			M8	M10	M12	M16	M20 [1]	M24 [1]
Pullout failure								
HST, HST-R and HST-HCR								
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					
Concrete cone and splitting failure								
HST, HST-R and HST-HCR								
Effective embedment depth	h_{ef}	[mm]	47	60	70	82	101	125
Factor for cracked concrete	k_{cr}	[-]	7,2					
Factor for non-cracked concrete	k_{ucr}	[-]	10,1					
Spacing	$s_{cr,N}$ $s_{cr,sp}$	[mm]	3 h_{ef}					
Edge distance	$c_{cr,N}$ $c_{cr,sp}$	[mm]	1,5 h_{ef}					
Partial safety factor	$\gamma_2 = \gamma_{inst}$	[-]	1,20	1,00				

[1] Only HST and HST-R

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Table C2: Characteristic tension resistance for Hilti metal expansion anchor HST3 and HST3-R in cracked and non-cracked concrete

			M8	M10	M12	M16	M20	M24
Steel failure								
HST3								
Characteristic resistance	$N_{Rk,s}$	[kN]	19,7	32,5	45,1	76,0	124,2	127,0
Partial safety factor	γ_{Ms} [1)]	[-]	1,40					1,41
HST3-R								
Characteristic resistance	$N_{Rk,s}$	[kN]	17,7	28,7	42,5	69,4	115,8	156,0
Partial safety factor	γ_{Ms} [1)]	[-]	1,40					1,56
Pullout failure								
HST3 and HST3-R								
Effective embedment depth	$h_{ef,2}$	[mm]	47	60	70	85	101	125
Characteristic resistance in cracked concrete C20/25	$N_{Rk,p}$	[kN]	7,5	12	20	[2)]	[2)]	40
Characteristic resistance in non-cracked concrete C20/25	$N_{Rk,p}$	[kN]	12	20	25	[2)]	[2)]	60
Partial safety factor	$\gamma_2 = \gamma_{inst}$	[-]	1,00					
HST3 and HST3-R								
Effective embedment depth	$h_{ef,1}$	[mm]	-	40	50	65	-	-
Characteristic resistance in cracked concrete C20/25	$N_{Rk,p}$	[kN]	-	[2)]	[2)]	[2)]	-	-
Characteristic resistance in non-cracked concrete C20/25	$N_{Rk,p}$	[kN]	-	[2)]	[2)]	[2)]	-	-
Partial safety factor	$\gamma_2 = \gamma_{inst}$	[-]	1,00					

[1)] In absence of other national regulations

[2)] Pullout failure not decisive

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Table C2 continued

			M8	M10	M12	M16	M20	M24
Pull out Failure								
HST3 und HST3-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					
Concrete cone and splitting failure								
HST3 und HST3-R								
Effective embedment depth	$h_{ef,2}$	[mm]	47	60	70	85	101	125
Factor for cracked concrete	k_{cr}	[-]	7,2					
Factor for non-cracked concrete	k_{ucr}	[-]	10,1					
Spacing	$s_{cr,N}$	[mm]	3 h_{ef}					
Edge distance	$c_{cr,N}$	[mm]	1,5 h_{ef}					
Spacing	$s_{cr,sp}$	[mm]	3 h_{ef}				3,8 h_{ef}	3 h_{ef}
Edge distance	$c_{cr,sp}$	[mm]	1,5 h_{ef}				1,9 h_{ef}	1,5 h_{ef}
Partial safety factor	$\gamma_2 = \gamma_{inst}$	[-]	1,00					
HST3 und HST3-R								
Effective embedment depth	$h_{ef,1}$	[mm]	-	40	50	65	-	-
Factor for cracked concrete	k_{cr}	[-]	-	7,2			-	-
Factor for non-cracked concrete	k_{ucr}	[-]	-	10,1			-	-
Spacing	$s_{cr,N}$	[mm]	-	3 h_{ef}			-	-
Edge distance	$c_{cr,N}$	[mm]	-	1,5 h_{ef}			-	-
Spacing	$s_{cr,sp}$	[mm]	-	4,2 h_{ef}	3,6 h_{ef}	3,2 h_{ef}	-	-
Edge distance	$c_{cr,sp}$	[mm]	-	2,1 h_{ef}	1,8 h_{ef}	1,6 h_{ef}	-	-
Partial safety factor	$\gamma_2 = \gamma_{inst}$	[-]	1,00					

Hilti metal expansion anchor HST, HST-R, HST-HCR, HST3, HST3-R

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

Annex C4

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Table C3: Characteristic shear resistance for Hilti metal expansion anchor HST, HST-R and HST-HCR in cracked and non-cracked concrete

			M8	M10	M12	M16	M20 [1]	M24 [1]
Steel failure without lever arm								
HST								
Characteristic resistance	$V_{Rk,s}$	[kN]	14,0	23,5	35,0	55,0	84,0	94,0
Partial safety factor	γ_{Ms} [2]	[-]	1,25					1,50
Ductility factor	k_2	[-]	1,00					
HST-R								
Characteristic resistance	$V_{Rk,s}$	[kN]	13,0	20,0	30,0	50,0	80,0	115,0
Partial safety factor	γ_{Ms} [2]	[-]	1,25			1,30	1,44	
Ductility factor	k_2	[-]	1,00					
HST-HCR								
Characteristic resistance	$V_{Rk,s}$	[kN]	13,0	20,0	30,0	55,0	-	-
Partial safety factor	γ_{Ms} [2]	[-]	1,25				-	-
Ductility factor	k_2	[-]	1,00				-	-
Steel failure with lever arm								
HST								
Characteristic resistance	$M^0_{Rk,s}$	[Nm]	30	60	105	240	454	595
Partial safety factor	γ_{Ms} [2]	[-]	1,25					1,50
HST-R								
Characteristic resistance	$M^0_{Rk,s}$	[Nm]	27	53	92	216	422	730
Partial safety factor	γ_{Ms} [2]	[-]	1,25			1,30	1,44	
HST-HCR								
Characteristic resistance	$M^0_{Rk,s}$	[Nm]	30	60	105	266	-	-
Partial safety factor	γ_{Ms} [2]	[-]	1,25				-	-

[1] Only HST and HST-R

[2] In absence of other national regulations

Hilti metal expansion anchor HST, HST-R, HST-HCR, HST3, HST3-R	**Annex C5**
Performances Characteristic values of resistance under shear loading in cracked and non-cracked concrete	

Deutsches Institut für Bautechnik DIBt

Table C3 continued

			M8	M10	M12	M16	M20 [1)]	M24 [1)]
Concrete pryout failure								
HST, HST-R and HST-HCR								
k-Factor	$k = k_3$	[-]	2,0	2,0	2,2	2,5	2,5	2,5
Partial safety factor	$\gamma_2 = \gamma_{inst}$	[-]	1,00					
Concrete edge failure								
HST, HST-R and HST-HCR								
Effective length of anchor in shear loading	l_f	[mm]	47	60	70	82	101	125
Diameter of anchor	d_{nom}	[mm]	8	10	12	16	20	24
Partial safety factor	$\gamma_2 = \gamma_{inst}$	[-]	1,00					

[1)] Only HST and HST-R

Hilti metal expansion anchor HST, HST-R, HST-HCR, HST3, HST3-R	**Annex C6**
Performances Characteristic values of resistance under shear loading in cracked and non-cracked concrete	

Deutsches Institut für Bautechnik DIBt

Table C4: Characteristic shear resistance for Hilti metal expansion anchor HST3 and HST3-R in cracked and non-cracked concrete

			M8	M10	M12	M16	M20	M24
Steel failure without lever arm								
HST3								
Effective embedment depth	$h_{ef,2}$	[mm]	47	60	70	85	101	125
Characteristic resistance	$V_{Rk,s}$	[kN]	13,8	23,6	35,4	55,3	83,9	94,0
Partial safety factor	γ_{Ms} [1)]	[-]	1,25					1,50
Ductility factor	k_2	[-]	1,00					
HST3-R								
Effective embedment depth	$h_{ef,2}$	[mm]	47	60	70	85	101	125
Characteristic resistance	$V_{Rk,s}$	[kN]	15,7	25,3	36,7	63,6	97,2	115,0
Partial safety factor	γ_{Ms} [1)]	[-]	1,25					1,30
Ductility factor	k_2	[-]	1,00					
HST3								
Effective embedment depth	$h_{ef,1}$	[mm]	-	40	50	65	-	-
Characteristic resistance	$V_{Rk,s}$	[kN]	-	21,9	34,0	54,5	-	-
Partial safety factor	γ_{Ms} [1)]	[-]	-	1,25			-	-
Ductility factor	k_2	[-]	-	1,00			-	-
HST3-R								
Effective embedment depth	$h_{ef,1}$	[mm]	-	40	50	65	-	-
Characteristic resistance	$V_{Rk,s}$	[kN]	-	25,6	31,1	48,6	-	-
Partial safety factor	γ_{Ms} [1)]	[-]	-	1,25			-	-
Ductility factor	k_2	[-]	-	1,00			-	-
Steel failure with lever arm								
HST3								
Characteristic resistance	$M^0_{Rk,s}$	[Nm]	30	60	105	240	457	595
Partial safety factor	γ_{Ms} [1)]	[-]	1,25					1,50
HST3-R								
Characteristic resistance	$M^0_{Rk,s}$	[Nm]	27	53	93	216	425	730
Partial safety factor	γ_{Ms} [1)]	[-]	1,25					1,30

[1)] In absence of other national regulations

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Table C4 continued

			M8	M10	M12	M16	M20	M24
Concrete pryout failure								
HST3 and HST3-R								
Effective embedment depth	$h_{ef,2}$	[mm]	47	60	70	85	101	125
k-Factor	$k = k_3$	[-]	2,62	2,67	2,78	3,41	3,20	2,50
Partial safety factor	$\gamma_2 = \gamma_{inst}$	[-]	1,00					
HST3 and HST3-R								
Effective embedment depth	$h_{ef,1}$	[mm]	-	40	50	65	-	-
k-Factor	$k = k_3$	[-]	-	2,67	2,78	3,41	-	-
Partial safety factor	$\gamma_2 = \gamma_{inst}$	[-]	1,00					
Concrete edge failure								
HST3 and HST3-R								
Effective length of anchor in shear loading	$l_{f,2}$	[mm]	47	60	70	85	101	125
Effective length of anchor in shear loading with shallow embedmenth depth	$l_{f,1}$	[mm]	-	40	50	65	-	-
Diameter of anchor	d_{nom}	[mm]	8	10	12	16	20	24
Partial safety factor	$\gamma_2 = \gamma_{inst}$	[-]	1,00					

[1] In absence of other national regulations

Hilti metal expansion anchor HST, HST-R, HST-HCR, HST3, HST3-R

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

Annex C8

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Table C5: Displacements under tension and shear loads for Hilti metal expansion anchor HST, HST-R and HST-HCR for static and quasi static loading

			M8	M10	M12	M16	M20 [1)]	M24 [1)]
Displacements under tension loading								
HST								
Tension load in cracked concrete	N	[kN]	2,0	4,3	5,7	9,5	14,3	19,0
Corresponding displacement	δ_{N0}	[mm]	1,3	0,2	0,1	0,5	1,9	2,2
	$\delta_{N\infty}$	[mm]	1,2	1,0	1,2	1,2	2,3	2,5
Tension load in non-cracked concrete	N	[kN]	3,6	7,6	9,5	16,7	23,8	28,6
Corresponding displacement	δ_{N0}	[mm]	0,2	0,1	0,1	0,4	0,6	0,5
	$\delta_{N\infty}$	[mm]	1,1	1,1	1,1	1,1	1,4	1,4
HST-R and HST-HCR								
Tension load in cracked concrete	N	[kN]	2,4	4,3	5,7	11,9	14,3	19,0
Corresponding displacement	δ_{N0}	[mm]	0,6	0,2	0,8	1,0	1,1	0,8
	$\delta_{N\infty}$	[mm]	1,5	1,2	1,4	1,2	1,2	1,7
Tension load in non-cracked concrete	N	[kN]	4,3	7,6	9,5	16,7	23,8	28,6
Corresponding displacement	δ_{N0}	[mm]	0,1	0,1	0,1	0,1	0,5	0,8
	$\delta_{N\infty}$	[mm]	1,5	1,2	1,4	1,2	1,2	1,7
Displacements under shear loading								
HST								
Shear load in cracked and non-cracked concrete	V	[kN]	8,0	13,4	20,0	31,4	48,0	45,0
Corresponding displacement	δ_{V0}	[mm]	2,5	2,5	3,7	4,0	2,7	2,0
	$\delta_{V\infty}$	[mm]	3,8	3,7	5,5	6,0	4,1	3,0
HST-R and HST-HCR								
Shear load in cracked and non-cracked concrete	V	[kN]	7,4	11,0	17,0	27,5	40,0	57,0
Corresponding displacement	δ_{V0}	[mm]	1,6	3,3	4,9	2,2	2,5	2,5
	$\delta_{V\infty}$	[mm]	2,4	4,9	7,4	3,3	3,7	3,7

[1)] Only HST and HST-R

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Table C6: Displacements under tension and shear loads for Hilti metal expansion anchor HST3 and HST3-R for static and quasi static loading

			M8	M10	M12	M16	M20	M24
Displacements under tension loading								
HST3								
Effective embedment depth	$h_{ef,2}$	[mm]	47	60	70	85	101	125
Tension load in cracked concrete	N	[kN]	3,6	5,7	9,5	13,4	17,4	19,0
Corresponding displacement	δ_{N0}	[mm]	0,6	0,6	0,8	1,8	1,3	2,2
	$\delta_{N\infty}$	[mm]	1,1	1,3	1,6	1,7	1,8	2,5
Tension load in non-cracked concrete	N	[kN]	5,7	9,5	11,9	18,9	24,4	28,6
Corresponding displacement	δ_{N0}	[mm]	0,2	0,3	0,2	0,8	0,5	0,5
	$\delta_{N\infty}$	[mm]	0,4	0,5	0,4	1,5	0,9	1,4
HST3-R								
Effective embedment depth	$h_{ef,2}$	[mm]	47	60	70	85	101	125
Tension load in cracked concrete	N	[kN]	3,6	5,7	9,5	13,4	17,4	19,0
Corresponding displacement	δ_{N0}	[mm]	0,6	0,6	0,8	1,8	1,3	0,8
	$\delta_{N\infty}$	[mm]	1,1	1,3	1,6	1,7	1,8	1,7
Tension load in non-cracked concrete	N	[kN]	5,7	9,5	11,9	18,9	24,4	28,6
Corresponding displacement	δ_{N0}	[mm]	0,2	0,3	0,2	0,8	0,5	0,8
	$\delta_{N\infty}$	[mm]	0,4	0,5	0,4	1,5	0,9	1,7
HST3 and HST3-R								
Effective embedment depth	$h_{ef,1}$	[mm]	-	40	50	65	-	-
Tension load in cracked concrete	N	[kN]	-	4,3	6,1	9,0	-	-
Corresponding displacement	δ_{N0}	[mm]	-	0,6	0,4	0,6	-	-
	$\delta_{N\infty}$	[mm]	-	1,3	1,6	1,7	-	-
Tension load in non-cracked concrete	N	[kN]	-	6,1	8,5	12,6	-	-
Corresponding displacement	δ_{N0}	[mm]	-	0,2	0,7	0,8	-	-
	$\delta_{N\infty}$	[mm]	-	0,4	1,2	1,5	-	-

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Table C6 continued

			M8	M10	M12	M16	M20	M24
Displacements under shear loading								
HST3								
Effective embedment depth	$h_{ef,2}$	[mm]	47	60	70	85	101	125
Shear load in cracked and non-cracked concrete	V	[kN]	7,9	13,5	20,2	31,6	47,9	45,0
Corresponding displacement	δ_{V0}	[mm]	2,8	2,5	3,8	4,3	2,7	2,0
	$\delta_{V\infty}$	[mm]	4,2	3,7	5,6	6,4	4,1	3,0
HST3-R								
Effective embedment depth	$h_{ef,2}$	[mm]	47	60	70	85	101	125
Shear load in cracked and non-cracked concrete	V	[kN]	8,9	14,5	21,0	36,3	55,6	57,0
Corresponding displacement	δ_{V0}	[mm]	7,1	2,3	3,3	5,7	3,2	2,5
	$\delta_{V\infty}$	[mm]	10,7	3,4	4,9	8,5	4,8	3,7
HST3								
Effective embedment depth	$h_{ef,1}$	[mm]	-	40	50	65	-	-
Shear load in cracked and non-cracked concrete	V	[kN]	-	12,5	19,4	31,1	-	-
Corresponding displacement	δ_{V0}	[mm]	-	4,2	3,1	4,4	-	-
	$\delta_{V\infty}$	[mm]	-	6,3	4,7	6,6	-	-
HST3-R								
Effective embedment depth	$h_{ef,1}$	[mm]	-	40	50	65	-	-
Shear load in cracked and non-cracked concrete	V	[kN]	-	14,6	17,8	27,8	-	-
Corresponding displacement	δ_{V0}	[mm]	-	3,7	3,9	3,5	-	-
	$\delta_{V\infty}$	[mm]	-	5,6	5,8	5,3	-	-

Hilti metal expansion anchor HST, HST-R, HST-HCR, HST3, HST3-R

Performances
Displacements under tension and shear loading

Annex C11

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Table C7: Characteristic tension resistance for seismic loading for Hilti metal expansion anchor HST and HST-R, performance category C1

			M8	M10	M12	M16	M20	M24
Steel failure								
HST								
Characteristic resistance	$N_{Rk,s,seis}$	[kN]	-	32	45	76	-	-
Partial safety factor	$\gamma_{Ms,seis}$ [1)]	[-]	-	1,50			-	-
HST-R								
Characteristic resistance	$N_{Rk,s,seis}$	[kN]	-	28	40	69	-	-
Partial safety factor	$\gamma_{Ms,seis}$ [1)]	[-]	-	1,50		1,56	-	-
Pullout failure								
HST and HST-R								
Characteristic resistance	$N_{Rk,p,seis}$	[kN]	-	8,0	10,7	18,0	-	-
Partial safety factor	$\gamma_2 = \gamma_{inst}$	[-]	-	1,00			-	-
Concrete cone failure [2)]								
HST and HST-R								
Partial safety factor	$\gamma_2 = \gamma_{inst}$	[-]	-	1,00			-	-
Splitting failure [2)]								
HST and HST-R								
Partial safety factor	$\gamma_2 = \gamma_{inst}$	[-]	-	1,00			-	-

[1)] In absence of other national regulations

[2)] For concrete cone failure and splitting failure see TR 045

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Table C8: Characteristic tension resistance for seismic loading for Hilti metal expansion anchor HST3 and HST3-R, performance category C1

			M8	M10	M12	M16	M20	M24
Steel failure								
HST3								
Effective embedment depth	$h_{ef,2}$	[mm]	47	60	70	85	101	-
Characteristic resistance	$N_{Rk,s,seis}$	[kN]	19,7	32,5	45,1	76,0	124,2	-
Partial safety factor	$\gamma_{Ms,seis}$ [1)]	[-]			1,40			-
HST3-R								
Effective embedment depth	$h_{ef,2}$	[mm]	47	60	70	85	101	-
Characteristic resistance	$N_{Rk,s,seis}$	[kN]	17,7	28,7	42,5	69,4	115,8	-
Partial safety factor	$\gamma_{Ms,seis}$ [1)]	[-]			1,40			-
Pullout failure								
HST3 and HST3-R								
Effective embedment depth	$h_{ef,2}$	[mm]	47	60	70	85	101	-
Characteristic resistance	$N_{Rk,p,seis}$	[kN]	7,5	12,0	20,0	[2)]	[2)]	-
Partial safety factor	$\gamma_2 = \gamma_{inst}$	[-]			1,00			-
Concrete cone failure [3)]								
HST3 and HST3-R								
Effective embedment depth	$h_{ef,2}$	[mm]	47	60	70	85	101	-
Partial safety factor	$\gamma_2 = \gamma_{inst}$	[-]			1,00			-
Splitting failure [3)]								
HST3 and HST3-R								
Effective embedment depth	$h_{ef,2}$	[mm]	47	60	70	85	101	-
Partial safety factor	$\gamma_2 = \gamma_{inst}$	[-]			1,00			-

[1)] In absence of other national regulations

[2)] Pullout failure not decisive

[3)] For concrete cone failure and splitting failure see TR 045

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Table C9: Characteristic shear resistance for seismic loading for Hilti metal expansion anchor HST and HST-R, performance category C1

			M8	M10	M12	M16	M20	M24
Steel failure								
HST								
Characteristic resistance	$V_{Rk,s,seis}$	[kN]	-	16,0	27,0	41,3	-	-
Partial safety factor	$\gamma_{Ms,seis}$ [1)]	[-]	-	1,25			-	-
HST-R								
Characteristic resistance	$V_{Rk,s,seis}$	[kN]	-	13,6	23,1	37,5	-	-
Partial safety factor	$\gamma_{Ms,seis}$ [1)]	[-]	-	1,25		1,30	-	-
Concrete pryout failure [2)]								
HST and HST-R								
Partial safety factor	$\gamma_2 = \gamma_{inst}$	[-]	-	1,00			-	-
Concrete edge failure [2)]								
HST and HST-R								
Partial safety factor	$\gamma_2 = \gamma_{inst}$	[-]	-	1,00			-	-

[1)] In absence of other national regulations

[2)] For concrete pryout failure and concrete edge failure see TR 045

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Table C10: Characteristic shear resistance for seismic loading for Hilti metal expansion anchor HST3 and HST3-R, performance category C1

			M8	M10	M12	M16	M20	M24
Steel failure								
HST3								
Effective embedment depth	$h_{ef,2}$	[mm]	47	60	70	85	101	-
Characteristic resistance	$V_{Rk,s,seis}$	[kN]	12,5	21,4	32,2	48,7	77,6	-
Partial safety factor	$\gamma_{Ms,seis}$ [1)]	[-]	1,25					-
HST3-R								
Effective embedment depth	$h_{ef,2}$	[mm]	47	60	70	85	101	-
Characteristic resistance	$V_{Rk,s,seis}$	[kN]	15,0	22,8	36,6	60,4	56,7	-
Partial safety factor	$\gamma_{Ms,seis}$ [1)]	[-]	1,25					-
Concrete pryout failure [2)]								
HST3 and HST3-R								
Effective embedment depth	$h_{ef,2}$	[mm]	47	60	70	85	101	-
Partial safety factor	$\gamma_2 = \gamma_{inst}$	[-]	1,00					-
Concrete edge failure [2)]								
HST3 and HST3-R								
Effective embedment depth	$h_{ef,2}$	[mm]	47	60	70	85	101	-
Partial safety factor	$\gamma_2 = \gamma_{inst}$	[-]	1,00					-

[1)] In absence of other national regulations

[2)] For concrete pryout failure and concrete edge failure see TR 045

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Table C11: Characteristic tension resistance for seismic loading for Hilti metal expansion anchor HST and HST-R, performance category C2

			M8	M10	M12	M16	M20	M24
Steel failure								
HST								
Characteristic resistance	$N_{Rk,s,seis}$	[kN]	-	32,0	45,0	76,0	-	-
Partial safety factor	$\gamma_{Ms,seis}$ [1)]	[-]	-	1,50			-	-
HST-R								
Characteristic resistance	$N_{Rk,s,seis}$	[kN]	-	28,0	40,0	69,0	-	-
Partial safety factor	$\gamma_{Ms,seis}$ [1)]	[-]	-	1,50		1,56	-	-
Pullout failure								
HST and HST-R								
Characteristic resistance	$N_{Rk,p,seis}$	[kN]	-	3,3	10,0	12,8	-	-
Partial safety factor	$\gamma_2 = \gamma_{inst}$	[-]	-	1,00			-	-
Concrete cone failure [2)]								
HST and HST-R								
Partial safety factor	$\gamma_2 = \gamma_{inst}$	[-]	-	1,00			-	-
Splitting failure [2)]								
HST and HST-R								
Partial safety factor	$\gamma_2 = \gamma_{inst}$	[-]	-	1,00			-	-

[1)] In absence of other national regulations

[2)] For concrete cone failure and splitting failure see TR 045

Table C12: Displacements under tension loads for seismic loading for Hilti metal expansion anchor HST and HST-R, performance category C2

			M8	M10	M12	M16	M20	M24
HST and HST-R								
Displacement DLS	$\delta_{N,seis}$	[mm]	-	1,4	6,7	4,0	-	-
Displacement ULS	$\delta_{N,seis}$	[mm]	-	8,6	15,9	13,3	-	-

Hilti metal expansion anchor HST, HST-R, HST-HCR, HST3, HST3-R	**Annex C16**
Performances Characteristic tension resistance and displacements under tension loads for seismic loading and performance category C2 according TR 045	

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Table C13: Characteristic tension resistance for seismic loading for Hilti metal expansion anchor HST3 and HST3-R, performance category C2

			M8	M10	M12	M16	M20	M24
Steel failure								
HST3								
Effective embedment depth	$h_{ef,2}$	[mm]	47	60	70	85	101	-
Characteristic resistance	$N_{Rk,s,seis}$	[kN]	19,7	32,5	45,1	76,0	124,2	-
Partial safety factor	$\gamma_{Ms,seis}$ [1)]	[-]			1,40			-
HST3-R								
Effective embedment depth	$h_{ef,2}$	[mm]	47	60	70	85	101	-
Characteristic resistance	$N_{Rk,s,seis}$	[kN]	17,7	28,7	42,5	69,4	115,8	-
Partial safety factor	$\gamma_{Ms,seis}$ [1)]	[-]			1,40			-
Pullout failure								
HST3								
Effective embedment depth	$h_{ef,2}$	[mm]	47	60	70	85	101	-
Characteristic resistance	$N_{Rk,p,seis}$	[kN]	3,0	10,4	19,5	[2)]	35,7	-
Partial safety factor	$\gamma_2 = \gamma_{inst}$	[-]			1,00			-
HST3-R								
Effective embedment depth	$h_{ef,2}$	[mm]	47	60	70	85	101	-
Characteristic resistance	$N_{Rk,p,seis}$	[kN]	3,4	10,4	19,5	[2)]	35,7	-
Partial safety factor	$\gamma_2 = \gamma_{inst}$	[-]			1,00			-
Concrete cone failure [3)]								
HST3 and HST3-R								
Effective embedment depth	$h_{ef,2}$	[mm]	47	60	70	85	101	-
Partial safety factor	$\gamma_2 = \gamma_{inst}$	[-]			1,00			-
Splitting failure [3)]								
HST3 and HST3-R								
Effective embedment depth	$h_{ef,2}$	[mm]	47	60	70	85	101	-
Partial safety factor	$\gamma_2 = \gamma_{inst}$	[-]			1,00			-

[1)] In absence of other national regulations

[2)] Pullout failure not decisive

[3)] For concrete cone failure and splitting failure see TR 045

Table C14: Displacements under tension loads for seismic loading for Hilti metal expansion anchor HST3 and HST3-R, performance category C2

			M8	M10	M12	M16	M20	M24
HST3 and HST3-R								
Displacement DLS	$\delta_{N,seis}$	[mm]	2,7	3,9	5,2	5,2	6,9	-
Displacement ULS	$\delta_{N,seis}$	[mm]	10,5	13,7	13,9	11,9	18,4	-

Table C15: Characteristic shear resistance for seismic loading for Hilti metal expansion anchor HST and HST-R, performance category C2

			M8	M10	M12	M16	M20	M24
Steel failure								
HST								
Characteristic resistance	$V_{Rk,s,seis}$	[kN]	-	14,3	21,0	41,3	-	-
Partial safety factor	$\gamma_{Ms,seis}$ [1)]	[-]	-	1,25			-	-
HST-R								
Characteristic resistance	$V_{Rk,s,seis}$	[kN]	-	12,0	18,0	37,5	-	-
Partial safety factor	$\gamma_{Ms,seis}$ [1)]	[-]	-	1,25		1,30	-	-
Concrete pryout failure [2)]								
HST and HST-R								
Partial safety factor	$\gamma_2 = \gamma_{inst}$	[-]	-	1,00			-	-
Concrete edge failure [2)]								
HST and HST-R								
Partial safety factor	$\gamma_2 = \gamma_{inst}$	[-]	-	1,00			-	-

[1)] In absence of other national regulations

[2)] For concrete pryout failure and concrete edge failure see TR 045

Table C16: Displacements under shear loads for seismic loading for Hilti metal expansion anchor HST and HST-R, performance category C2

			M8	M10	M12	M16	M20	M24
HST and HST-R								
Displacement DLS	$\delta_{V,seis}$	[mm]	-	4,2	5,3	5,7	-	-
Displacement ULS	$\delta_{V,seis}$	[mm]	-	7,5	7,9	8,9	-	-

Hilti metal expansion anchor HST, HST-R, HST-HCR, HST3, HST3-R	**Annex C18**
Performances Characteristic shear resistance and displacements under shear loads for seismic loading and performance category C2 according TR 045	

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Table C17: Characteristic shear resistance for seismic loading for Hilti metal expansion anchor HST3 and HST3-R, performance category C2

			M8	M10	M12	M16	M20	M24
Steel failure								
HST3								
Effective embedment depth	$h_{ef,2}$	[mm]	47	60	70	85	101	-
Characteristic resistance	$V_{Rk,s,seis}$	[kN]	9,5	16,1	26,1	42,4	66,9	-
Partial safety factor	$\gamma_{Ms,seis}$ [1)]	[-]			1,25			-
HST3-R								
Effective embedment depth	$h_{ef,2}$	[mm]	47	60	70	85	101	-
Characteristic resistance	$V_{Rk,s,seis}$	[kN]	8,1	15,7	22,4	42,6	49,5	-
Partial safety factor	$\gamma_{Ms,seis}$ [1)]	[-]			1,25			-
Concrete pryout failure [2)]								
HST3 and HST3-R								
Effective embedment depth	$h_{ef,2}$	[mm]	47	60	70	85	101	-
Partial safety factor	$\gamma_2 = \gamma_{inst}$	[-]			1,00			-
Concrete edge failure [2)]								
HST3 and HST3-R								
Effective embedment depth	$h_{ef,2}$	[mm]	47	60	70	85	101	-
Partial safety factor	$\gamma_2 = \gamma_{inst}$	[-]			1,00			-

[1)] In absence of other national regulations

[2)] For concrete cone failure and splitting failure see TR 045

Table C18: Displacements under shear loads for seismic loading for Hilti metal expansion anchor HST3 and HST3-R, performance category C2

			M8	M10	M12	M16	M20	M24
HST3								
Displacement DLS	$\delta_{V,seis}$	[mm]	3,4	4,0	4,6	4,8	5,2	-
Displacement ULS	$\delta_{V,seis}$	[mm]	4,9	6,2	8,1	8,2	10,0	-
HST3-R								
Displacement DLS	$\delta_{V,seis}$	[mm]	3,5	5,0	6,0	5,8	3,9	-
Displacement ULS	$\delta_{V,seis}$	[mm]	7,5	9,1	10,1	12,3	7,0	-

Hilti metal expansion anchor HST, HST-R, HST-HCR, HST3, HST3-R

Performances
Characteristic shear resistance and displacements under shear loads for seismic loading and performance category C2 according TR 045

Annex C19

Table C19: Characteristic tension resistance under fire exposure for Hilti metal expansion anchor HST, HST-R and HST-HCR in cracked and non-cracked concrete

				M8	M10	M12	M16	M20 [1)]	M24 [1)]
Steel failure									
HST									
Characteristic resistance	R30	$N_{Rk,s,fi}$	[kN]	0,9	2,5	5,0	9,0	15,0	20,0
	R60	$N_{Rk,s,fi}$	[kN]	0,7	1,5	3,5	6,0	10,0	15,0
	R90	$N_{Rk,s,fi}$	[kN]	0,6	1,0	2,0	3,5	6,0	8,0
	R120	$N_{Rk,s,fi}$	[kN]	0,5	0,7	1,0	2,0	3,5	5,0
HST-R and HST HCR									
Characteristic resistance	R30	$N_{Rk,s,fi}$	[kN]	4,9	11,8	17,2	32,0	49,9	71,9
	R60	$N_{Rk,s,fi}$	[kN]	3,6	8,4	12,2	22,8	35,5	51,2
	R90	$N_{Rk,s,fi}$	[kN]	2,4	5,0	7,3	13,5	21,1	30,4
	R120	$N_{Rk,s,fi}$	[kN]	1,7	3,3	4,8	8,9	13,9	20,0
Pullout failure									
HST									
Characteristic resistance in concrete ≥ C20/25	R30	$N_{Rk,p,fi}$	[kN]	1,3	2,3	3,0	5,0	7,5	10,0
	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	6,0	8,0
HST-R and HST-HCR									
Characteristic resistance in concrete ≥ C20/25	R30	$N_{Rk,p,fi}$	[kN]	1,3	2,3	3,0	6,3	7,5	10,0
	R60	$N_{Rk,p,fi}$	[kN]						
	R90	$N_{Rk,p,fi}$	[kN]						
	R120	$N_{Rk,p,fi}$	[kN]	1,0	1,8	2,4	5,0	6,0	8,0

[1)] Only HST and HST-R

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 HST, HST-R, HST-HCR, HST3, HST3-R	**Annex C20**
Performances Characteristic values of resistance under tension loading under fire exposure in cracked and non-cracked concrete	

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Table C19 continued

				M8	M10	M12	M16	M20 [1)]	M24 [1)]
Concrete cone failure									
HST, HST-R and HST-HCR									
Characteristic resistance in concrete ≥ C20/25	R30	$N^0_{Rk,c,fi}$	[kN]	2,7	5,0	7,4	11,0	18,5	31,4
	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	14,8	25,2
Spacing		$s_{cr,N}$	[mm]	4 h_{ef}					
		s_{min}	[mm]	40	55	60	70	100	125
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)] Only HST and HST-R

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 HST, HST-R, HST-HCR, HST3, HST3-R

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

Annex C21

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Table C20: Characteristic tension resistance under fire exposure for Hilti metal expansion anchor HST3 and HST3-R in cracked and non-cracked concrete

				M8	M10	M12	M16	M20	M24
Steel failure									
HST3									
Effective embedment depth		$h_{ef,2}$	[mm]	47	60	70	85	101	125
Characteristic resistance	R30	$N_{Rk,s,fi}$	[kN]	0,9	2,4	5,2	9,7	15,2	21,9
	R60	$N_{Rk,s,fi}$	[kN]	0,8	1,8	3,7	6,8	10,6	15,3
	R90	$N_{Rk,s,fi}$	[kN]	0,7	1,2	2,1	3,9	6,0	8,7
	R120	$N_{Rk,s,fi}$	[kN]	0,6	0,9	1,3	2,4	3,8	5,4
HST3-R									
Effective embedment depth		$h_{ef,2}$	[mm]	47	60	70	85	101	125
Characteristic resistance	R30	$N_{Rk,s,fi}$	[kN]	4,9	11,8	17,1	31,9	49,8	71,8
	R60	$N_{Rk,s,fi}$	[kN]	3,6	8,4	12,2	22,8	35,5	51,2
	R90	$N_{Rk,s,fi}$	[kN]	2,4	5,0	7,3	13,6	21,2	30,6
	R120	$N_{Rk,s,fi}$	[kN]	1,7	3,3	4,8	9,0	14,1	20,3
HST3									
Effective embedment depth		$h_{ef,1}$	[mm]	-	40	50	65	-	-
Characteristic resistance	R30	$N_{Rk,s,fi}$	[kN]	-	1,5	2,3	4,4	-	-
	R60	$N_{Rk,s,fi}$	[kN]	-	1,2	1,7	3,2	-	-
	R90	$N_{Rk,s,fi}$	[kN]	-	0,9	1,1	2,1	-	-
	R120	$N_{Rk,s,fi}$	[kN]	-	0,8	0,8	1,5	-	-
HST3-R									
Effective embedment depth		$h_{ef,1}$	[mm]	-	40	50	65	-	-
Characteristic resistance	R30	$N_{Rk,s,fi}$	[kN]	-	5,2	9,1	16,9	-	-
	R60	$N_{Rk,s,fi}$	[kN]	-	3,7	6,8	12,6	-	-
	R90	$N_{Rk,s,fi}$	[kN]	-	2,5	4,5	8,4	-	-
	R120	$N_{Rk,s,fi}$	[kN]	-	2,0	3,3	6,2	-	-

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 HST, HST-R, HST-HCR, HST3, HST3-R

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

Annex C22

Deutsches Institut für Bautechnik DIBt

Table C20 continued

				M8	M10	M12	M16	M20	M24
Pullout failure									
HST3 and HST3-R									
Effective embedment depth		$h_{ef,2}$	[mm]	47	60	70	85	101	125
Characteristic resistance in concrete ≥ C20/25	R30	$N_{Rk,p,fi}$	[kN]	1,9	3,0	5,0	7,1	9,1	12,6
	R60	$N_{Rk,p,fi}$	[kN]						
	R90	$N_{Rk,p,fi}$	[kN]						
	R120	$N_{Rk,p,fi}$	[kN]	1,5	2,4	4,0	5,6	7,3	10,1
HST3 and HST3-R									
Effective embedment depth		$h_{ef,1}$	[mm]	-	40	50	65	-	-
Characteristic resistance in concrete ≥ C20/25	R30	$N_{Rk,p,fi}$	[kN]	-	2,3	3,2	4,7	-	-
	R60	$N_{Rk,p,fi}$	[kN]						
	R90	$N_{Rk,p,fi}$	[kN]						
	R120	$N_{Rk,p,fi}$	[kN]	-	1,8	2,5	3,8	-	-

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 HST, HST-R, HST-HCR, HST3, HST3-R

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

Annex C23

Deutsches Institut für Bautechnik DIBt

Table C20 continued

				M8	M10	M12	M16	M20	M24
Concrete cone failure									
HST3 and HST3-R									
Effective embedment depth		$h_{ef,2}$	[mm]	47	60	70	85	101	125
Characteristic resistance in concrete ≥ C20/25	R30	$N^0_{Rk,c,fi}$	[kN]	2,7	5,0	7,4	12,0	18,5	31,4
	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	9,6	14,8	25,2
Spacing		$s_{cr,N}$	[mm]	$4\ h_{ef}$					
		s_{min}	[mm]	35	40	50	65	90	125
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					
HST3 and HST3-R									
Effective embedment depth		$h_{ef,1}$	[mm]	-	40	50	65	-	-
Characteristic resistance in concrete ≥ C20/25	R30	$N^0_{Rk,c,fi}$	[kN]	-	1,8	3,2	6,1	-	-
	R60	$N^0_{Rk,c,fi}$	[kN]						
	R90	$N^0_{Rk,c,fi}$	[kN]						
	R120	$N^0_{Rk,c,fi}$	[kN]	-	1,5	2,5	4,9	-	-
Spacing		$s_{cr,N}$	[mm]	-	$4\ h_{ef}$			-	-
		s_{min}	[mm]	-	40	50	65	-	-
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.

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Table C21: Characteristic shear resistance under fire exposure for Hilti metal expansion anchor HST, HST-R and HST-HCR in cracked and non-cracked concrete

				M8	M10	M12	M16	M20 [1)]	M24 [1)]
Steel failure without lever arm									
HST									
Characteristic resistance	R30	$V^0_{Rk,s,fi}$	[kN]	0,9	2,5	5,0	9,0	15,0	20,0
	R60	$V^0_{Rk,s,fi}$	[kN]	0,7	1,5	3,5	6,0	10,0	15,0
	R90	$V^0_{Rk,s,fi}$	[kN]	0,6	1,0	2,0	3,5	6,0	8,0
	R120	$V^0_{Rk,s,fi}$	[kN]	0,5	0,7	1,0	2,0	3,5	5,0
HST-R and HST HCR									
Characteristic resistance	R30	$V^0_{Rk,s,fi}$	[kN]	4,9	11,8	17,2	32,0	49,9	71,9
	R60	$V^0_{Rk,s,fi}$	[kN]	3,6	8,4	12,2	22,8	35,5	51,2
	R90	$V^0_{Rk,s,fi}$	[kN]	2,4	5,0	7,3	13,5	21,1	30,4
	R120	$V^0_{Rk,s,fi}$	[kN]	1,7	3,3	4,8	8,9	13,9	20,0
Steel failure with lever arm									
HST									
Characteristic resistance	R30	$M^0_{Rk,s,fi}$	[Nm]	1,0	3,3	8,1	20,6	40,2	69,5
	R60	$M^0_{Rk,s,fi}$	[Nm]	0,8	2,4	5,7	14,4	28,1	48,6
	R90	$M^0_{Rk,s,fi}$	[Nm]	0,7	1,6	3,2	8,2	16,0	27,7
	R120	$M^0_{Rk,s,fi}$	[Nm]	0,6	1,2	2,0	5,1	9,9	17,2
HST-R and HST HCR									
Characteristic resistance	R30	$M^0_{Rk,s,fi}$	[Nm]	5,0	15,2	26,6	67,7	132,3	228,6
	R60	$M^0_{Rk,s,fi}$	[Nm]	3,7	10,8	19,0	48,2	94,1	162,6
	R90	$M^0_{Rk,s,fi}$	[Nm]	2,4	6,4	11,3	28,6	55,9	96,6
	R120	$M^0_{Rk,s,fi}$	[Nm]	1,8	4,2	7,4	18,9	36,8	63,7

[1)] Only HST and HST-R

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 HST, HST-R, HST-HCR, HST3, HST3-R	**Annex C25**
Performances Characteristic values of resistance under shear loading under fire exposure in cracked and non-cracked concrete	

Table C21 continued

				M8	M10	M12	M16	M20 [1)]	M24 [1)]
Concrete pryout failure									
HST, HST-R and HST-HCR									
k-Factor		$k = k_3$	[-]	2,00	2,00	2,20	2,50	2,50	2,50
Characteristic resistance in concrete ≥ C20/25	R30	$V^0_{Rk,cp,fi}$	[kN]	5,4	10,0	16,0	27,2	49,4	84,5
	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	39,6	67,5
Concrete edge failure									
HST, HST-R and HST-HCR									
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.									

[1)] Only HST and HST-R

In absence of other national regulations the partial safety factor for resistance under fire exposure $\gamma_{M,fi} = 1,0$ is recommended.

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Table C22: Characteristic shear resistance under fire exposure for Hilti metal expansion anchor HST3 and HST3-R in cracked and non-cracked concrete

				M8	M10	M12	M16	M20	M24
Steel failure without lever arm									
HST3									
Effective embedment depth		$h_{ef,2}$	[mm]	47	60	70	85	101	125
Characteristic resistance	R30	$V_{Rk,s,fi}$	[kN]	0,9	2,4	5,2	9,7	15,2	21,9
	R60	$V_{Rk,s,fi}$	[kN]	0,8	1,8	3,7	6,8	10,6	15,3
	R90	$V_{Rk,s,fi}$	[kN]	0,7	1,2	2,1	3,9	6,0	8,7
	R120	$V_{Rk,s,fi}$	[kN]	0,6	0,9	1,3	2,4	3,8	5,4
HST3-R									
Effective embedment depth		$h_{ef,2}$	[mm]	47	60	70	85	101	125
Characteristic resistance	R30	$V_{Rk,s,fi}$	[kN]	4,9	11,8	17,1	31,9	49,8	71,8
	R60	$V_{Rk,s,fi}$	[kN]	3,6	8,4	12,2	22,8	35,5	51,2
	R90	$V_{Rk,s,fi}$	[kN]	2,4	5,0	7,3	13,6	21,2	30,6
	R120	$V_{Rk,s,fi}$	[kN]	1,7	3,3	4,8	9,0	14,1	20,3
HST3									
Effective embedment depth		$h_{ef,1}$	[mm]	-	40	50	65	-	-
Characteristic resistance	R30	$V_{Rk,s,fi}$	[kN]		1,5	2,3	4,4		
	R60	$V_{Rk,s,fi}$	[kN]		1,2	1,7	3,2		
	R90	$V_{Rk,s,fi}$	[kN]		0,9	1,1	2,1		
	R120	$V_{Rk,s,fi}$	[kN]		0,8	0,8	1,5		
HST3-R									
Effective embedment depth		$h_{ef,1}$	[mm]	-	40	50	65	-	-
Characteristic resistance	R30	$V_{Rk,s,fi}$	[kN]		5,2	9,1	16,9		
	R60	$V_{Rk,s,fi}$	[kN]		3,7	6,8	12,6		
	R90	$V_{Rk,s,fi}$	[kN]		2,5	4,5	8,4		
	R120	$V_{Rk,s,fi}$	[kN]		2,0	3,3	6,2		

In absence of other national regulations the partial safety factor for resistance under fire exposure $\gamma_{M,fi}$ = 1,0 is recommended.

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Table C22 continued

				M8	M10	M12	M16	M20	M24
Steel failure with lever arm									
HST3									
Effective embedment depth		$h_{ef,2}$	[mm]	47	60	70	85	101	125
Characteristic resistance	R30	$M^0_{Rk,s,fi}$	[Nm]	0,9	3,1	8,1	20,6	40,2	69,5
	R60	$M^0_{Rk,s,fi}$	[Nm]	0,8	2,4	5,7	14,4	28,1	48,6
	R90	$M^0_{Rk,s,fi}$	[Nm]	0,7	1,6	3,2	8,2	16,0	27,7
	R120	$M^0_{Rk,s,fi}$	[Nm]	0,6	1,2	2,0	5,1	10,0	17,2
HST3-R									
Effective embedment depth		$h_{ef,2}$	[mm]	47	60	70	85	101	125
Characteristic resistance	R30	$M^0_{Rk,s,fi}$	[Nm]	5,0	15,2	26,6	67,6	132,0	228,2
	R60	$M^0_{Rk,s,fi}$	[Nm]	3,7	10,8	19,0	48,2	94,1	162,7
	R90	$M^0_{Rk,s,fi}$	[Nm]	2,4	6,5	11,3	28,8	56,3	97,2
	R120	$M^0_{Rk,s,fi}$	[Nm]	1,8	4,3	7,5	19,1	37,3	64,5
HST3									
Effective embedment depth		$h_{ef,1}$	[mm]	-	40	50	65	-	-
Characteristic resistance	R30	$M^0_{Rk,s,fi}$	[Nm]	-	2,0	3,6	9,3	-	-
	R60	$M^0_{Rk,s,fi}$	[Nm]	-	1,6	2,7	6,9	-	-
	R90	$M^0_{Rk,s,fi}$	[Nm]	-	1,2	1,8	4,5	-	-
	R120	$M^0_{Rk,s,fi}$	[Nm]	-	1,0	1,3	3,3	-	-
HST3-R									
Effective embedment depth		$h_{ef,1}$	[mm]	-	40	50	65	-	-
Characteristic resistance	R30	$M^0_{Rk,s,fi}$	[Nm]	-	6,7	14,1	35,9	-	-
	R60	$M^0_{Rk,s,fi}$	[Nm]	-	4,8	10,5	26,8	-	-
	R90	$M^0_{Rk,s,fi}$	[Nm]	-	3,2	7,0	17,7	-	-
	R120	$M^0_{Rk,s,fi}$	[Nm]	-	2,6	5,2	13,2	-	-

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 HST, HST-R, HST-HCR, HST3, HST3-R

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

Annex C28

Table C22 continued

				M8	M10	M12	M16	M20	M24
Concrete pryout failure									
HST3 and HST3-R									
Effective embedment depth		$h_{ef,2}$	[mm]	47	60	70	85	101	125
k-Factor		$k = k_3$	[-]	2,62	2,67	2,78	3,41	3,20	2,50
Characteristic resistance in concrete ≥ C20/25	R30	$V^0_{Rk,cp,fi}$	[kN]	7,0	13,0	20,7	40,8	37,0	62,8
	R60	$V^0_{Rk,cp,fi}$	[kN]						
	R90	$V^0_{Rk,cp,fi}$	[kN]						
	R120	$V^0_{Rk,cp,fi}$	[kN]	5,7	10,4	16,5	32,6	29,6	50,4
HST3 and HST3-R									
Effective embedment depth		$h_{ef,1}$	[mm]	-	40	50	65	-	-
k-Factor		$k = k_3$	[-]	-	2,67	2,78	3,41	-	-
Characteristic resistance in concrete ≥ C20/25	R30	$V^0_{Rk,cp,fi}$	[kN]	-	4,7	8,9	20,8	-	-
	R60	$V^0_{Rk,cp,fi}$	[kN]						
	R90	$V^0_{Rk,cp,fi}$	[kN]						
	R120	$V^0_{Rk,cp,fi}$	[kN]	-	3,8	7,1	16,7	-	-
Concrete edge failure									
HST3 and HST3-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.