

Approval body for construction products
and types of construction

Bautechnisches Prüfamt

An institution established by the Federal and
Laender Governments



European Technical Assessment

ETA-98/0001
of 28 July 2016

English translation prepared by DIBt - Original version in German language

General Part

Technical Assessment Body issuing the
European Technical Assessment:

Deutsches Institut für Bautechnik

Trade name of the construction product

Hilti 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

60 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",
used as European Assessment Document (EAD)
according to Article 66 Paragraph 3 of Regulation (EU)
No 305/2011.

This version replaces

ETA-98/0001 issued on 6 November 2015

European Technical Assessment

ETA-98/0001

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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 C12
Characteristic resistance for seismic performance category C1, displacements	See Annex C13 to C16
Characteristic resistance for seismic performance category C2, displacements	See Annex C17 to C21

3.2 Safety in case of fire (BWR 2)

Essential characteristic	Performance
Reaction to fire	Anchors satisfy requirements for Class A1
Resistance to fire	See Annex C22 to C31

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 28 July 2016 by Deutsches Institut für Bautechnik

Uwe Bender
Head of Department

beglaubigt:
Lange

Installed condition

Figure A1:
Hilti metal expansion anchor HST, HST-R and HST-HCR

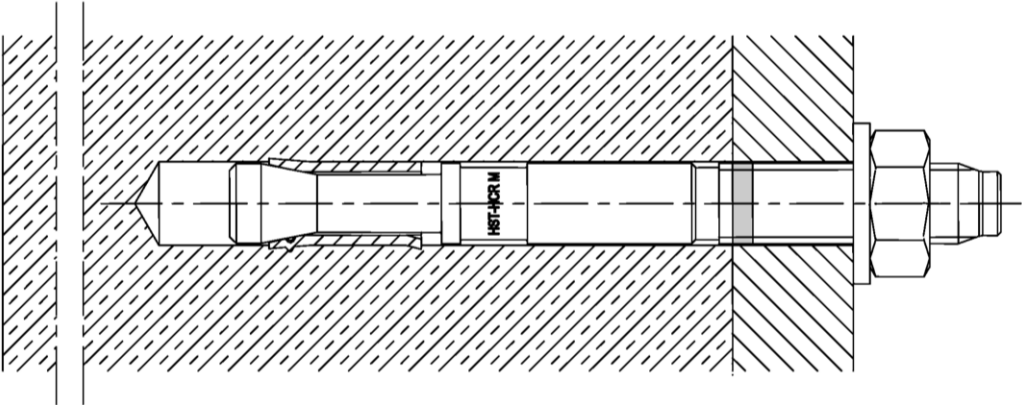
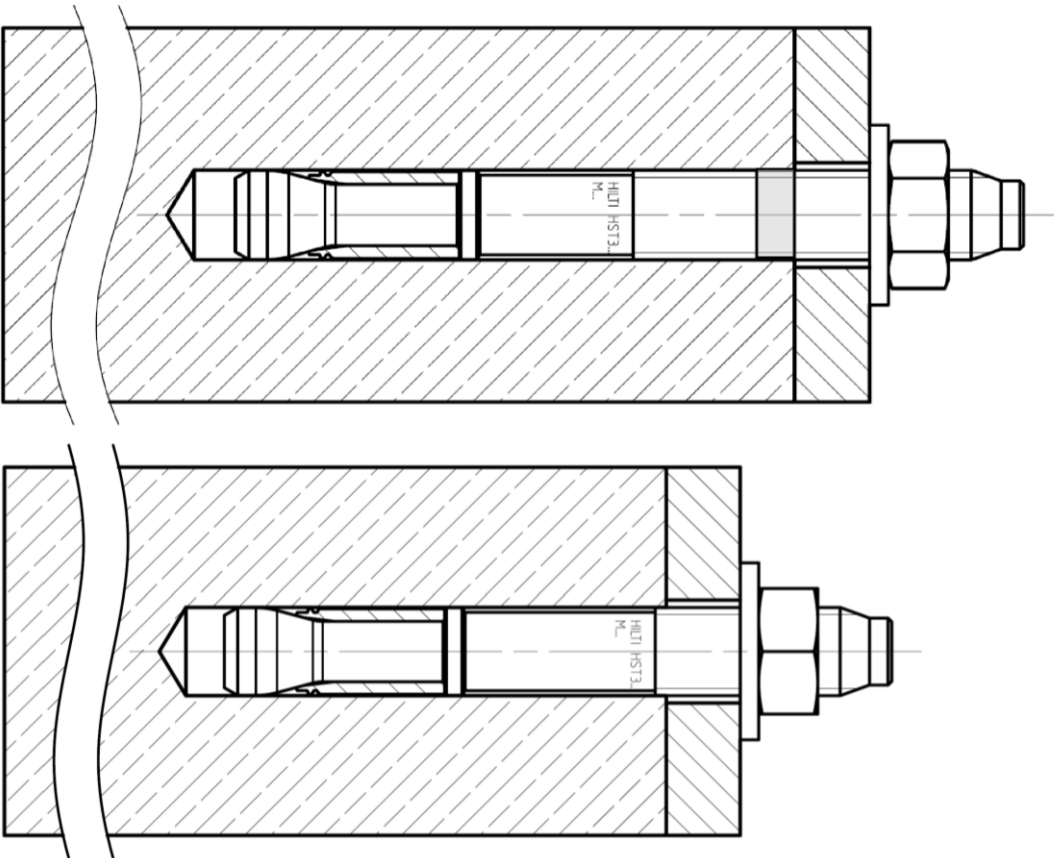


Figure A2:
Hilti metal expansion anchor HST3 and HST3-R with standard and shallow embedment depth

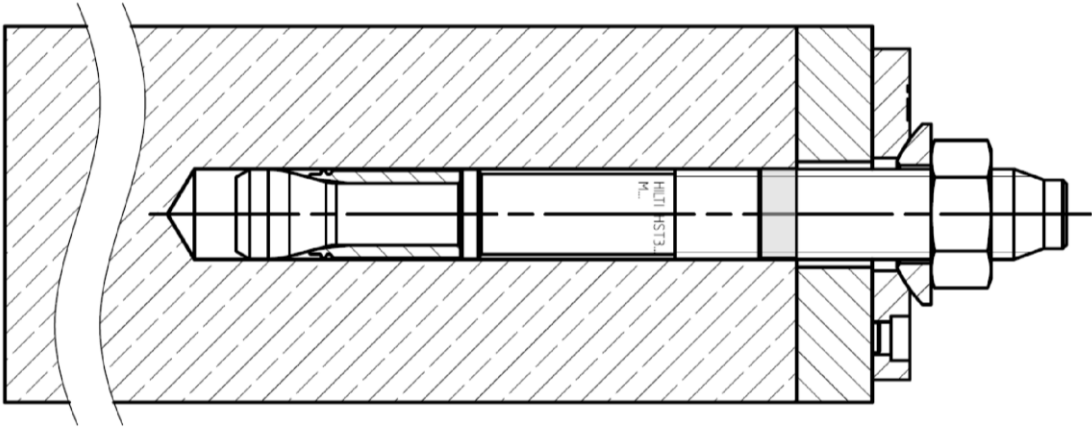


Hilti metal expansion anchor HST, HST-R, HST-HCR, HST3, HST3-R

Product description
Installed condition

Annex A1

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

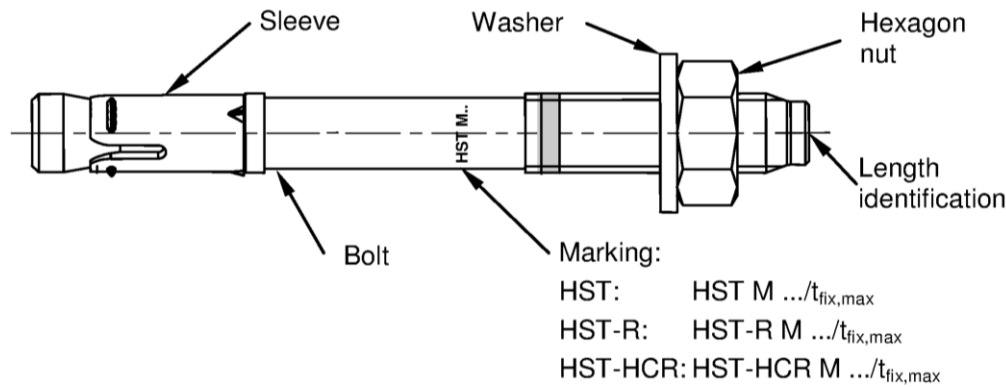


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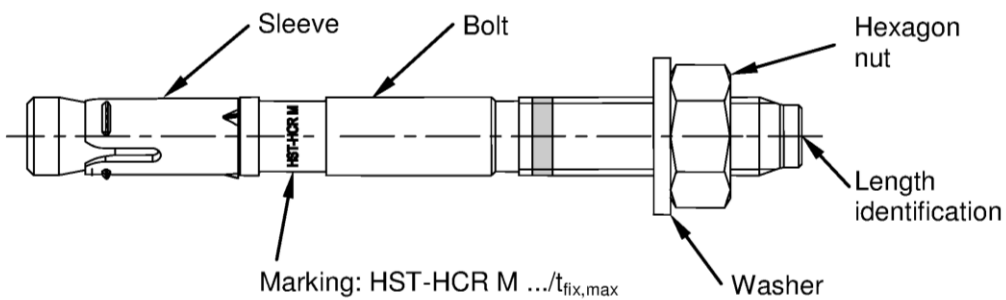
Hilti metal expansion anchor HST, HST-R, HST-HCR, HST3, HST3-R		Annex A2
Product description Installed condition		

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

Cold-formed version



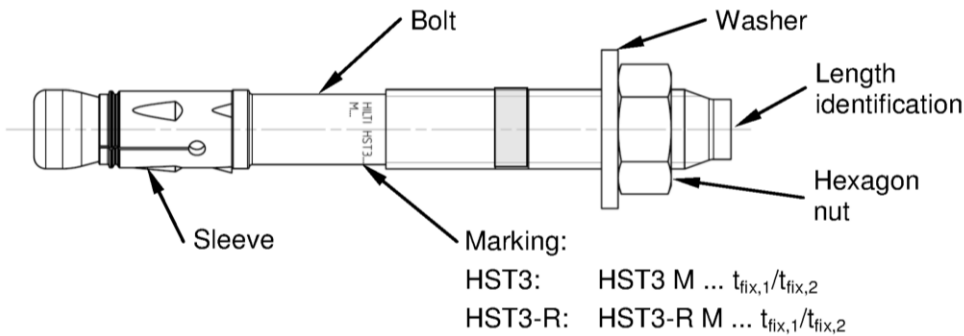
Machined version



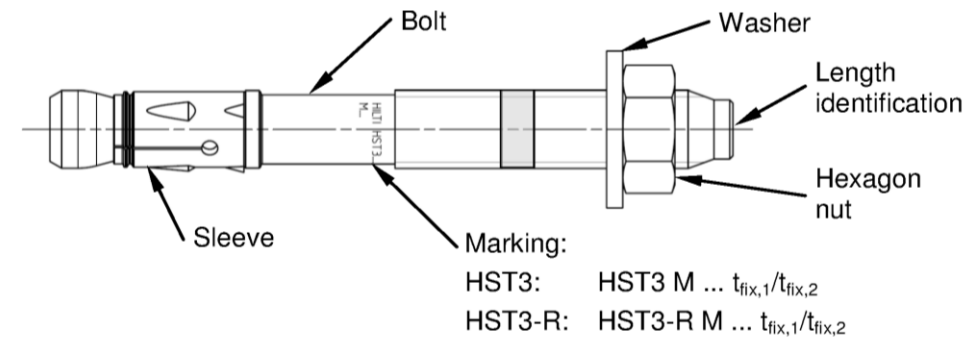
Hilti metal expansion anchor HST, HST-R, HST-HCR, HST3, HST3-R	
Product description Anchor types, marking and identification after installation	Annex A3

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

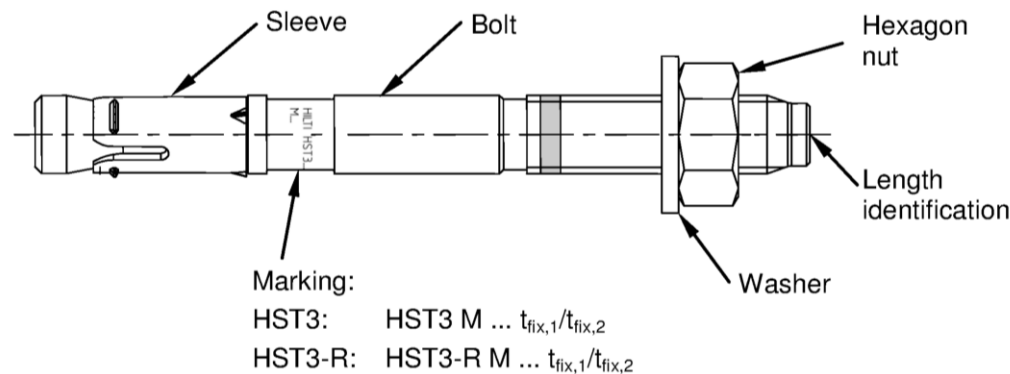
Cold-formed version



Machined version M8 - M16



Machined version M20 - M24



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

Product description
Anchor types, marking and identification after installation

Annex A4

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

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

Product description
Materials

Annex A6

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

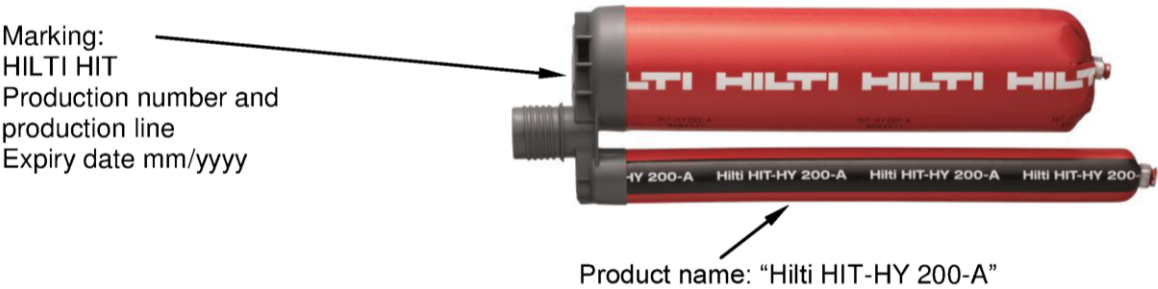
Hilti metal expansion anchor HST, HST-R, HST-HCR, HST3, HST3-R

Product description
Materials

Annex A7

Injection mortar Hilti HIT-HY 200-A

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



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

Product description
Injection mortar

Annex A8

Dimensions

HST, HST-R and HST-HCR

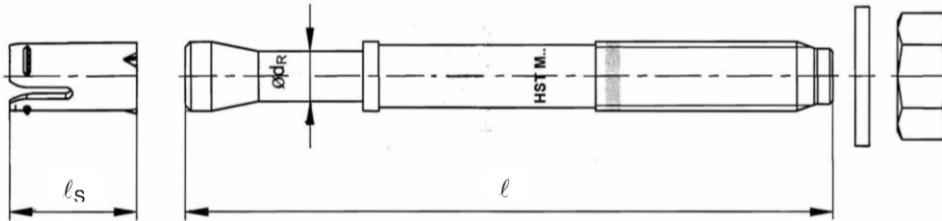


Table A4: Dimensions HST, HST-R and HST-HCR

HST, HST-R, HST-HCR			M8	M10	M12	M16	M20 ¹⁾	M24 ¹⁾
Maximum length of anchor	$l_{\max} \leq$	[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 HST3-R

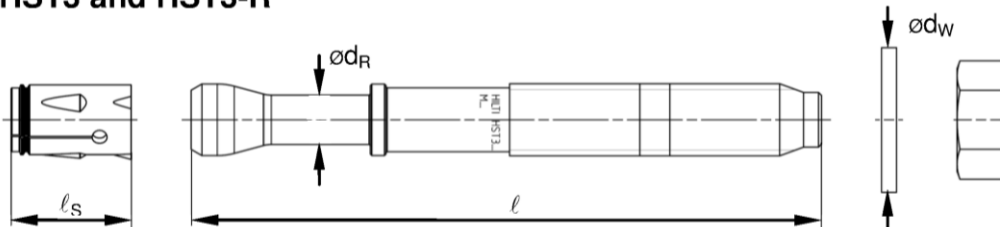


Table A5: Dimensions HST3 and HST3-R

HST3, HST3-R			M8	M10	M12	M16	M20	M24
Maximum length of anchor	$l_{\max} \leq$	[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

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

Product description
Dimensions

Annex A9

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

Sealing washer

Spherical washer

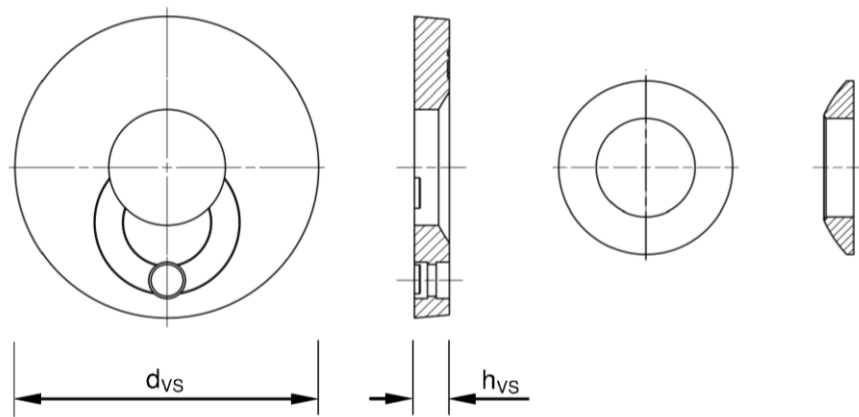


Table A6: Dimensions Seismic/Filling Set

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	

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

Product description
Dimensions

Annex A10

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 shall be positioned outside of critical regions (e.g. plastic hinges) of the concrete structure. Fastenings where shear loads act on anchors with a lever arm, such as e.g. in stand-off installation or with a grout layer, are not covered.
- Anchorages under fire exposure are designed in accordance with:
EOTA Technical Report TR 020, Edition May 2004
CEN/TS 1992-4:2009, Annex D
In case of requirements to resistance to fire local spalling of the concrete cover must be avoided.

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

Specifications of intended use

Annex B1

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.

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

Specifications of intended use

Annex B2

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 ²⁾	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	SW	[mm]	13	17	19	24	30	36

¹⁾ Only HST and HST-R

²⁾ For bigger clearance holes in the fixture see ETAG 001 Annex C Chapter 4.2.2.1

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

Intended use
Installation parameters

Annex B3

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} ≤	[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} ≥	[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} ≥	[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 ²⁾	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	SW	[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

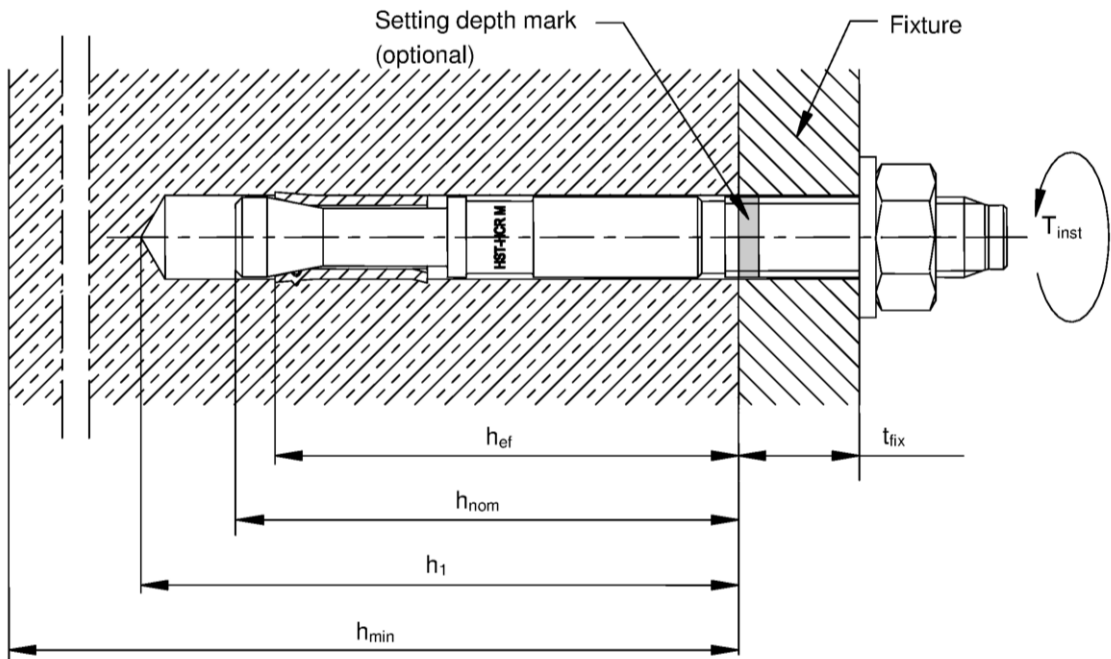
²⁾ For bigger clearance holes in the fixture see ETAG 001 Annex C Chapter 4.2.2.1

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

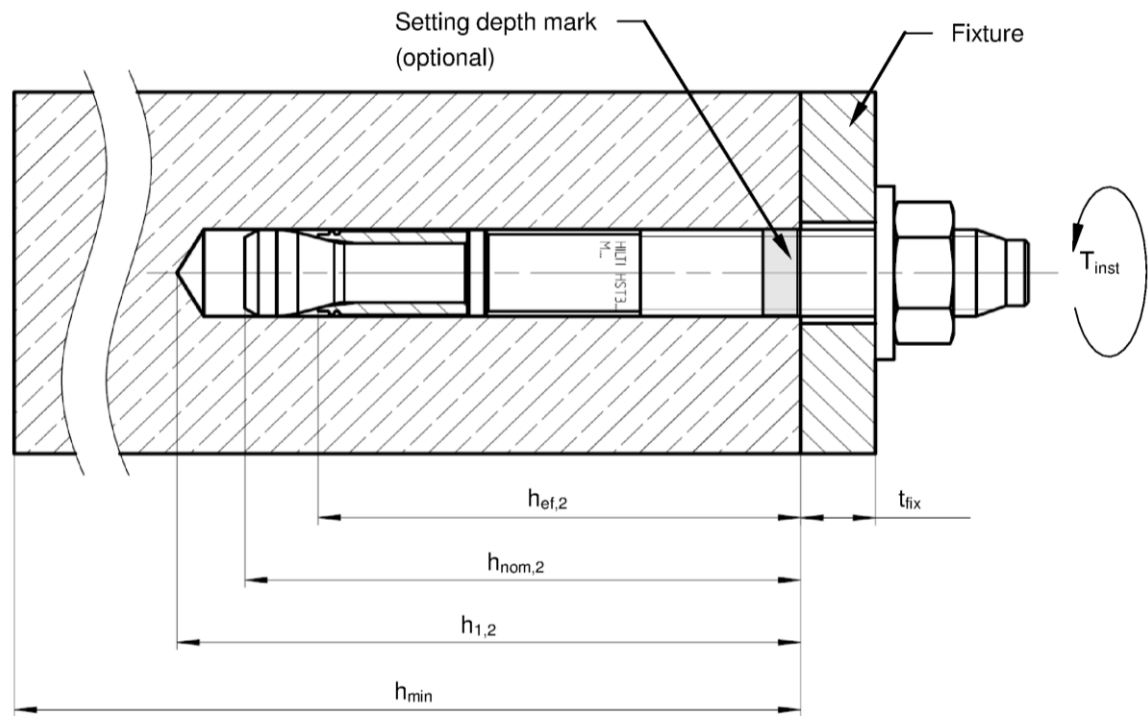
Intended use
Installation parameters

Annex B4

HST, HST-R and HST-HCR



HST3 and HST3-R (standard embedment depth)

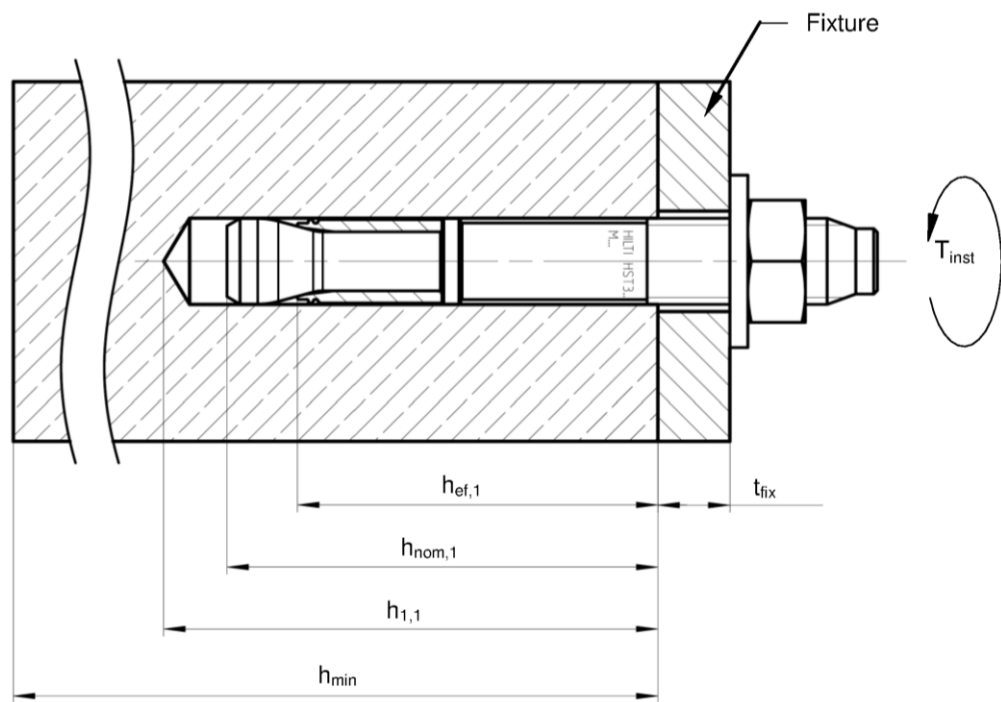


Hilti metal expansion anchor HST, HST-R, HST-HCR, HST3, HST3-R

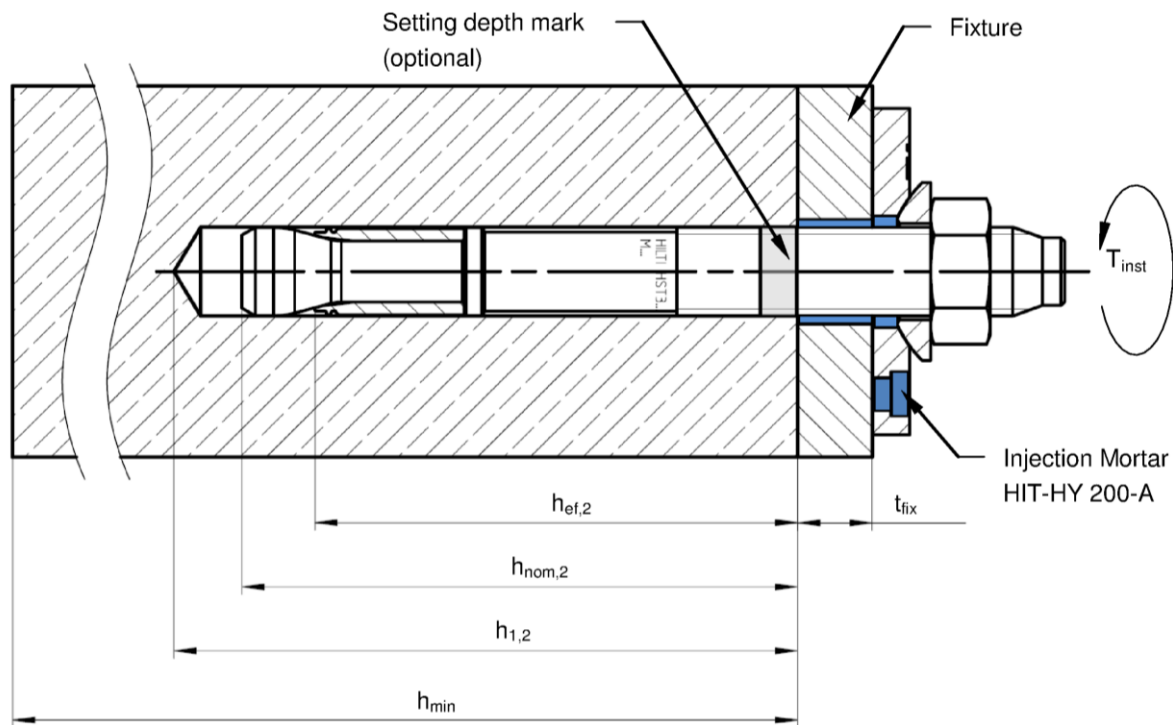
Intended Use
Installation parameters

Annex B5

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

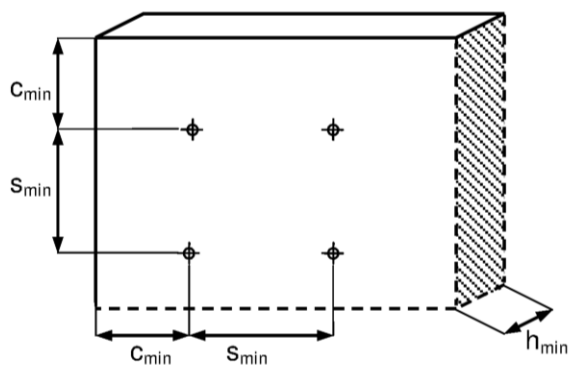
Annex B6

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 $c \geq$ [mm]	50	70	75	100	160	180
Minimum edge distance ²⁾	c_{min} [mm]	45	55	55	70	100	125
	for $s \geq$ [mm]	50	90	120	150	225	240
HST-R							
Minimum spacing ²⁾	s_{min} [mm]	40	55	60	70	100	125
	for $c \geq$ [mm]	50	65	75	100	130	130
Minimum edge distance ²⁾	c_{min} [mm]	45	50	55	60	100	125
	for $s \geq$ [mm]	50	90	110	160	160	140
HST-HCR							
Minimum spacing ²⁾	s_{min} [mm]	40	55	60	70	-	-
	for $c \geq$ [mm]	50	70	75	100	-	-
Minimum edge distance ²⁾	c_{min} [mm]	45	50	55	60	-	-
	for $s \geq$ [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

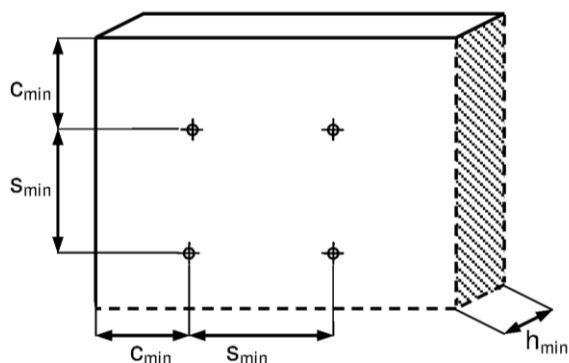
Annex B7

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 $c \geq$ [mm]	50	80	85	110	225	255
Minimum edge distance ²⁾	c_{min} [mm]	50	55	55	85	140	170
	for $s \geq$ [mm]	60	115	145	150	270	295
HST-R							
Minimum spacing ²⁾	s_{min} [mm]	60	55	60	70	100	125
	for $c \geq$ [mm]	60	70	80	110	195	205
Minimum edge distance ²⁾	c_{min} [mm]	60	50	55	70	140	150
	for $s \geq$ [mm]	60	115	145	160	210	235
HST-HCR							
Minimum spacing ²⁾	s_{min} [mm]	60	55	60	70	-	-
	for $c \geq$ [mm]	50	70	80	110	-	-
Minimum edge distance ²⁾	c_{min} [mm]	60	55	55	70	-	-
	for $s \geq$ [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

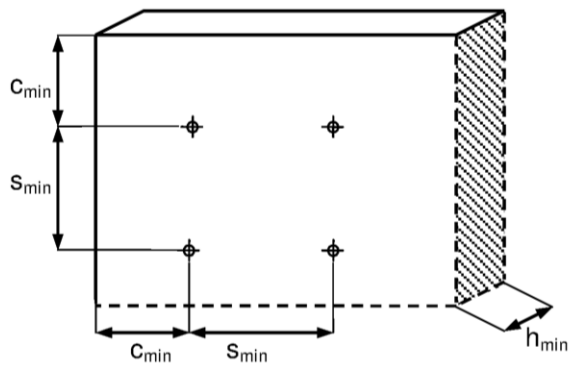
Intended Use
Minimum spacing and minimum edge distance

Annex B8

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	$h_{\text{ef},2}$ [mm]	47	60	70	85	101	125
Cracked concrete							
HST3							
Minimum spacing ¹⁾	$s_{\min}$ [mm]	35	40	50	65	90	125
	for $c \geq$ [mm]	50	55	70	95	130	180
Minimum edge distance ¹⁾	$c_{\min}$ [mm]	40	45	55	65	80	125
	for $s \geq$ [mm]	50	80	110	150	180	240
HST3-R							
Minimum spacing ¹⁾	$s_{\min}$ [mm]	35	40	50	65	90	125
	for $c \geq$ [mm]	50	55	70	95	130	130
Minimum edge distance ¹⁾	$c_{\min}$ [mm]	40	45	55	65	80	125
	for $s \geq$ [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

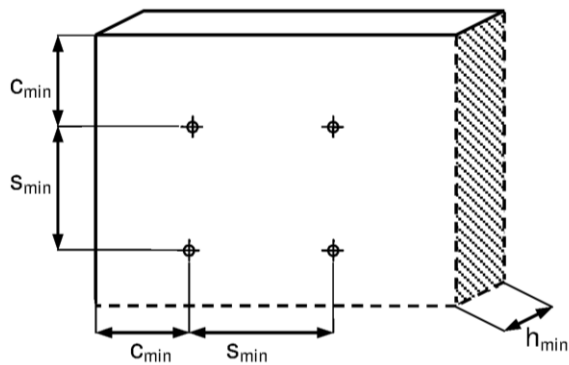
Intended Use
Minimum spacing and minimum edge distance

Annex B9

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	$h_{\text{ef},2}$ [mm]	47	60	70	85	101	125
Non-cracked concrete							
HST3							
Minimum spacing ¹⁾	$s_{\min}$ [mm]	35	40	60	65	90	125
	for $c \geq$ [mm]	50	60	70	95	130	255
Minimum edge distance ¹⁾	$c_{\min}$ [mm]	40	50	55	65	80	170
	for $s \geq$ [mm]	50	90	110	150	180	295
HST3-R							
Minimum spacing ¹⁾	$s_{\min}$ [mm]	35	40	60	65	90	125
	for $c \geq$ [mm]	50	60	70	95	130	205
Minimum edge distance ¹⁾	$c_{\min}$ [mm]	40	50	55	65	80	150
	for $s \geq$ [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

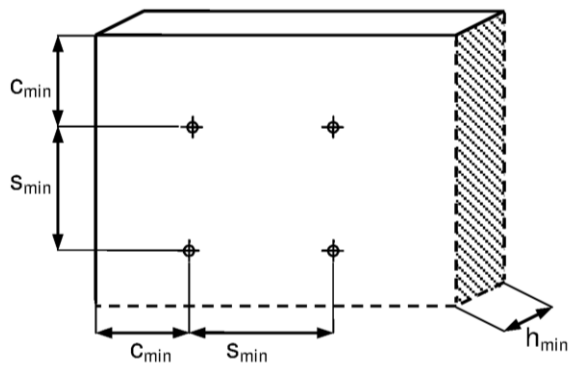
Minimum spacing and minimum edge distance

Annex B10

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	$h_{\text{ef},2}$ [mm]	47	60	70	85	101	-
Cracked concrete							
HST3 and HST3-R							
Minimum spacing ¹⁾	$s_{\min}$ [mm]	35	40	50	80	120	-
	for $c \geq$ [mm]	50	100	90	130	180	-
Minimum edge distance ¹⁾	$c_{\min}$ [mm]	40	60	60	65	120	-
	for $s \geq$ [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 $c \geq$ [mm]	55	100	100	130	180	-
Minimum edge distance ¹⁾	$c_{\min}$ [mm]	40	60	60	65	120	-
	for $s \geq$ [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

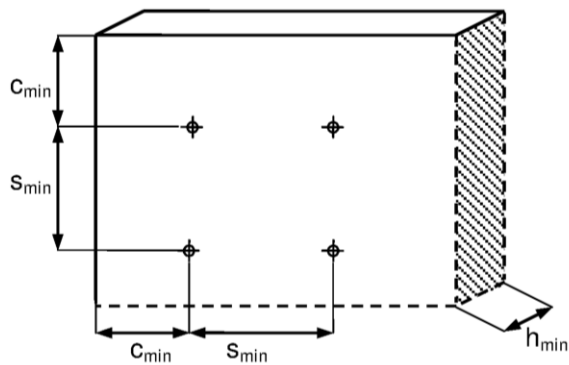
Minimum spacing and minimum edge distance

Annex B11

Table B5 continued

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

¹⁾ Linear interpolation for $s_{\min}$ and $c_{\min}$ allowed



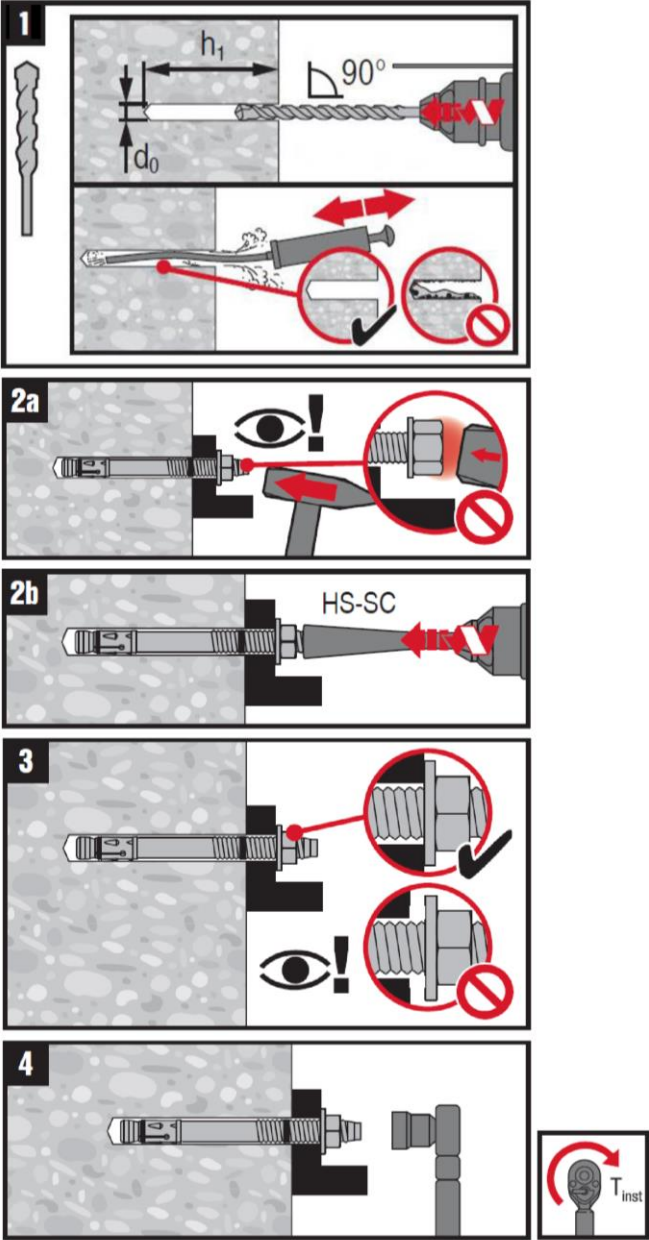
Hilti metal expansion anchor HST, HST-R, HST-HCR, HST3, HST3-R

Intended Use

Minimum spacing and minimum edge distance

Annex B12

Installation instruction HST, HST-R and HST-HCR

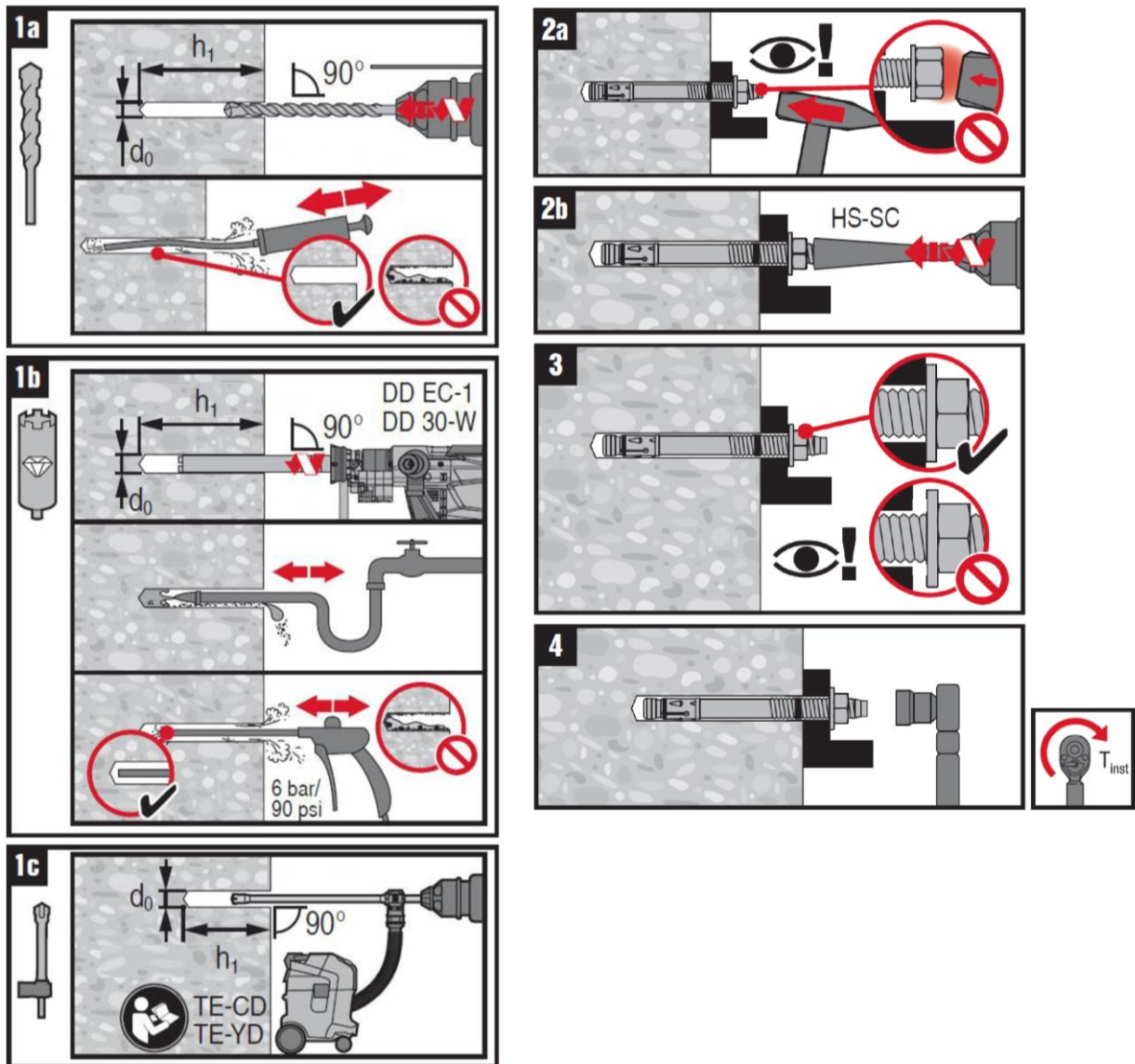


Hilti metal expansion anchor HST, HST-R, HST-HCR, HST3, HST3-R

Intended Use
Installation instructions

Annex B13

Installation instruction HST3 and HST3-R

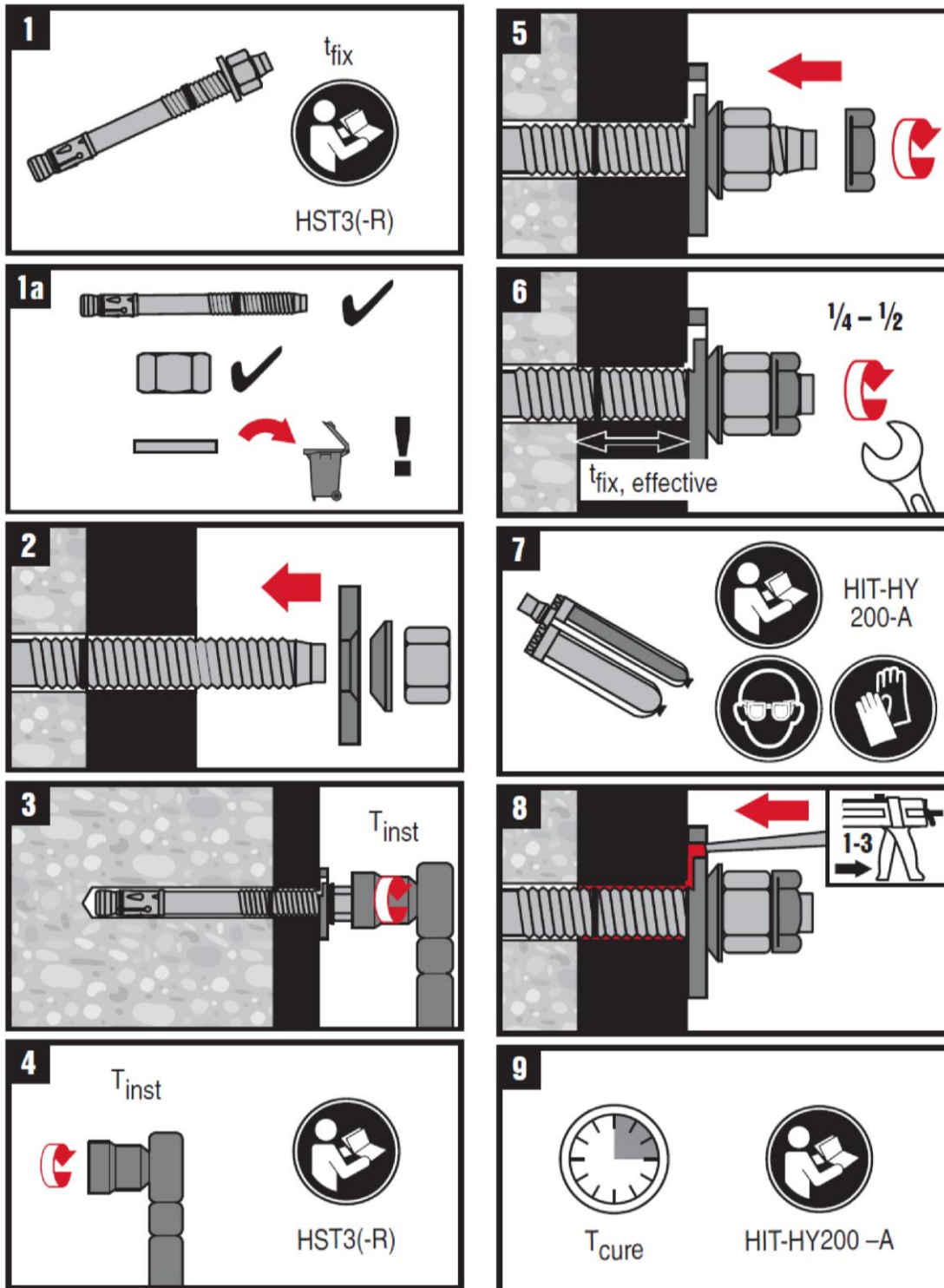


Hilti metal expansion anchor HST, HST-R, HST-HCR, HST3, HST3-R

Intended Use
Installation instructions

Annex B14

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



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

Intended Use
Installation instructions

Annex B15

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]	19,0	32,0	45,0	76,0	117,0	127,0
Partial safety factor	γ _{Ms} ²⁾	[-]	1,50					1,41
HST-R								
Characteristic resistance	N _{Rk,s}	[kN]	17,0	28,0	40,0	69,0	109,0	156,0
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]	5,0	9,0	12,0	20,0	30,0	40,0
Characteristic resistance in non-cracked concrete C20/25	N _{Rk,p}	[kN]	9,0	16,0	20,0	35,0	50,0	60,0
Partial safety factor	γ ₂ = γ _{inst}	[-]	1,20	1,00				
HST-R								
Characteristic resistance in cracked concrete C20/25	N _{Rk,p}	[kN]	5,0	9,0	12,0	25,0	30,0	40,0
Characteristic resistance in non-cracked concrete C20/25	N _{Rk,p}	[kN]	9,0	16,0	20,0	35,0	50,0	60,0
Partial safety factor	γ ₂ = γ _{inst}	[-]	1,00					
HST-HCR								
Characteristic resistance in cracked concrete C20/25	N _{Rk,p}	[kN]	5,0	9,0	12,0	25,0	-	-
Characteristic resistance in cracked concrete C50/60	N _{Rk,p}	[kN]	9,0	16,0	20,0	35,0	-	-
Partial safety factor	γ ₂ = γ _{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

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

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 C2

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	$\gamma_{Ms}^{1)}$	[-]	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	$\gamma_{Ms}^{1)}$	[-]	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	12,0	20,0	2)	2)	40,0
Characteristic resistance in non-cracked concrete C20/25	$N_{Rk,p}$	[kN]	12,0	20,0	25,0	2)	2)	60,0
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

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 C3

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

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

Performances

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

Annex C5

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	γ ₂ = γ _{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	γ ₂ = γ _{inst}	[-]	1,00					

¹⁾ Only HST and HST-R

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 C6

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
Characteristic resistance using Seismic/Filling Set	$V_{Rk,s}$	[kN]	16,6	25,8	39,0	60,9	100,4	-
Partial safety factor	$\gamma_{Ms}^{1)}$	[-]	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
Characteristic resistance using Seismic/Filling Set	$V_{Rk,s}$	[kN]	19,5	28,4	44,3	70,2	102,7	-
Partial safety factor	$\gamma_{Ms}^{1)}$	[-]	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	$\gamma_{Ms}^{1)}$	[-]	-	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	$\gamma_{Ms}^{1)}$	[-]	-	1,25			-	-
Ductility factor	k_2	[-]	-	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 C7

Table C4 continued

		M8	M10	M12	M16	M20	M24
Steel failure with lever arm							
HST3							
Characteristic resistance	$M^0_{RK,s}$ [Nm]	30	60	105	240	457	595
Partial safety factor	$\gamma_{Ms}^{1)}$ [-]	1,25					1,50
HST3-R							
Characteristic resistance	$M^0_{RK,s}$ [Nm]	27	53	93	216	425	730
Partial safety factor	$\gamma_{Ms}^{1)}$ [-]	1,25					1,30
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 embedment 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

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

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

Performances

Displacements under tension and shear loading

Annex C9

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	-	-

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

Performances

Displacements under tension and shear loading

Annex C10

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
Shear load in cracked and non-cracked concrete using Seismic/Filling Set	V	[kN]	9,5	14,7	22,3	34,8	57,4	-
Corresponding displacement	δ_{V0}	[mm]	2,9	2,3	2,0	2,3	5,9	-
	$\delta_{V\infty}$	[mm]	4,4	3,4	3,0	3,5	8,8	-
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
Shear load in cracked and non-cracked concrete using Seismic/Filling Set	V	[kN]	11,1	16,2	25,3	40,1	58,7	-
Corresponding displacement	δ_{V0}	[mm]	1,9	2,0	2,3	3,4	4,9	-
	$\delta_{V\infty}$	[mm]	2,9	3,0	3,4	5,0	7,3	-

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

Performances

Displacements under tension and shear loading

Annex C11

Table C6 continued

			M8	M10	M12	M16	M20	M24
Displacements under shear loading								
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 C12

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]	-	32,0	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]	-	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

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

Performances

Characteristic tension resistance for seismic loading and performance category C1 according TR 045

Annex C13

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

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

Performances

Characteristic tension resistance for seismic loading and performance category C1 according TR 045

Annex C14

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

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

Performances

Characteristic shear resistance for seismic loading and performance category C1 according TR 045

Annex C15

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	-
Characteristic resistance using Seismic/Filling Set	$V_{Rk,s,seis}$	[kN]	16,6	25,8	39,0	60,9	100,4	-
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	-
Characteristic resistance using Seismic/Filling Set	$V_{Rk,s,seis}$	[kN]	19,5	28,4	44,3	70,2	102,7	-
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

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

Performances

Characteristic shear resistance for seismic loading and performance category C1 according TR 045

Annex C16

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

Performances

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

Annex C17

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

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

Performances

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

Annex C18

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

Performances

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

Annex C19

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	-
Characteristic resistance using Seismic/Filling Set	$V_{Rk,s,seis}$	[kN]	9,9	19,0	28,6	48,5	84,3	-
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	-
Characteristic resistance using Seismic/Filling Set	$V_{Rk,s,seis}$	[kN]	9,9	17,2	27,6	42,5	67,4	-
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

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 C20

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 DLS using Seismic/Filling Set	$\delta_{V,seis}$ [mm]	1,4	1,6	2,5	1,7	1,9	-
Displacement ULS	$\delta_{V,seis}$ [mm]	4,9	6,2	8,1	8,2	10,0	-
Displacement ULS using Seismic/Filling Set	$\delta_{V,seis}$ [mm]	4,3	4,4	7,2	3,9	5,3	-
HST3-R							
Displacement DLS	$\delta_{V,seis}$ [mm]	3,5	5,0	6,0	5,8	3,9	-
Displacement DLS using Seismic/Filling Set	$\delta_{V,seis}$ [mm]	1,6	1,6	2,0	1,9	2,2	-
Displacement ULS	$\delta_{V,seis}$ [mm]	7,5	9,1	10,1	12,3	7,0	-
Displacement ULS using Seismic/Filling Set	$\delta_{V,seis}$ [mm]	5,0	7,6	6,8	4,7	5,8	-

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

Annex C21

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 $\geq C20/25$	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 $\geq C20/25$	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

Performances

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

Annex C22

Table C19 continued

				M8	M10	M12	M16	M20 ¹⁾	M24 ¹⁾
Concrete cone failure									
HST, HST-R and HST-HCR									
Characteristic resistance in concrete $\geq$ C20/25	R30	$N_{Rk,c,fi}^0$	[kN]	2,7	5,0	7,4	11,0	18,5	31,4
	R60	$N_{Rk,c,fi}^0$	[kN]						
	R90	$N_{Rk,c,fi}^0$	[kN]						
	R120	$N_{Rk,c,fi}^0$	[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 C23

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 C24

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 $\geq C20/25$	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 $\geq C20/25$	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 C25

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 $\geq$ 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 $\geq$ 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.

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 C26

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	$V_{Rk,s,fi}$	[kN]	0,9	2,5	5,0	9,0	15,0	20,0
	R60	$V_{Rk,s,fi}$	[kN]	0,7	1,5	3,5	6,0	10,0	15,0
	R90	$V_{Rk,s,fi}$	[kN]	0,6	1,0	2,0	3,5	6,0	8,0
	R120	$V_{Rk,s,fi}$	[kN]	0,5	0,7	1,0	2,0	3,5	5,0
HST-R and HST HCR									
Characteristic resistance	R30	$V_{Rk,s,fi}$	[kN]	4,9	11,8	17,2	32,0	49,9	71,9
	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	13,5	21,1	30,4
	R120	$V_{Rk,s,fi}$	[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

Performances

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

Annex C27

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 $\geq$ C20/25	R30	$V_{Rk,cp,fi}^0$	[kN]	5,4	10,0	16,0	27,2	49,4	84,5
	R60	$V_{Rk,cp,fi}^0$	[kN]						
	R90	$V_{Rk,cp,fi}^0$	[kN]						
	R120	$V_{Rk,cp,fi}^0$	[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 $V_{Rk,c,fi}^0$ of the characteristic resistance in concrete C20/25 to C50/60 under fire exposure may be determined by: $V_{Rk,c,fi}^0 = 0,25 \times V_{Rk,c}^0$ ($\leq$ R90) $V_{Rk,c,fi}^0 = 0,20 \times V_{Rk,c}^0$ (R120) with $V_{Rk,c}^0$ 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.

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: 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.

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 C29

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 C30

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 $\geq$ C20/25	R30	$V_{Rk,cp,fi}^0$ [kN]	7,0	13,0	20,7	40,8	37,0	62,8
	R60	$V_{Rk,cp,fi}^0$ [kN]						
	R90	$V_{Rk,cp,fi}^0$ [kN]						
	R120	$V_{Rk,cp,fi}^0$ [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 $\geq$ C20/25	R30	$V_{Rk,cp,fi}^0$ [kN]	-	4,7	8,9	20,8	-	-
	R60	$V_{Rk,cp,fi}^0$ [kN]						
	R90	$V_{Rk,cp,fi}^0$ [kN]						
	R120	$V_{Rk,cp,fi}^0$ [kN]	-	3,8	7,1	16,7	-	-
Concrete edge failure								
HST3 and HST3-R								
The initial value $V_{Rk,c,fi}^0$ of the characteristic resistance in concrete C20/25 to C50/60 under fire exposure may be determined by: $V_{Rk,c,fi}^0 = 0,25 \times V_{Rk,c}^0$ ($\leq$ R90) $V_{Rk,c,fi}^0 = 0,20 \times V_{Rk,c}^0$ (R120) with $V_{Rk,c}^0$ 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 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 C31