Deutsches Institut für Bautechnik
DIBt

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European Technical Assessment Body for construction products

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European Technical Assessment

ETA-21/0480 of 31 October 2024

English translation prepared by DIBt - Original version in German language

General Part

Technical Assessment Body issuing the European Technical Assessment:	Deutsches Institut für Bautechnik
Trade name of the construction product	Hilti metal expansion anchor HST2 V3
Product family to which the construction product belongs	Mechanical fastener for use in concrete
Manufacturer	Hilti Aktiengesellschaft Feldkircherstrasse 100 9494 SCHAAN FÜRSTENTUM LIECHTENSTEIN
Manufacturing plant	Hilti plants
This European Technical Assessment contains	40 pages including 3 annexes which form an integral part of this assessment
This European Technical Assessment is issued in accordance with Regulation (EU) No 305/2011, on the basis of	EAD 330232-01-0601-v03, Edition 06/2023

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Specific part

1 Technical description of the product

The Hilti metal expansion anchor HST2 V3, HST2 V3 BW, HST2-F V3 and HST2-R V3 is an anchor made of galvanized steel (HST2 V3 and HST2 V3 BW), hot dip galvanized steel (HST2-F V3) or stainless steel (HST2-R V3) which is placed into a drilled hole and anchored by torque-controlled expansion.

The product description is given in Annex A.

2 Specification of the intended use in accordance with the applicable European Assessment Document

The performances given in Section 3 are only valid if the fastener is used in compliance with the specifications and conditions given in Annex B.

The verifications and assessment methods on which this European Technical Assessment is based lead to the assumption of a working life of the fastener 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 to tension load (static and quasi-static loading) Method A	see Annex B7 – B9 and C1 – C4
Characteristic resistance to shear load (static and quasi-static loading)	see Annex C5
Displacements	see Annex C6
Characteristic resistance and displacements for seismic performance categories C1 and C2	see Annex C7 – C11
Durability	see Annex B1

3.2 Safety in case of fire (BWR 2)

Essential characteristic	Performance
Reaction to fire	Class A1
Resistance to fire	see Annex C12 – C18

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

In accordance with the European Assessment Document EAD 330232-01-0601-v03 the applicable European legal act is: 1996/582/EC.

The system to be applied is: 1

5 Technical details necessary for the implementation of the AVCP system, as provided for in the applicable EAD

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

Issued in Berlin on 31 October 2024 by Deutsches Institut für Bautechnik

Dipl.-Ing. Beatrix Wittstock
Head of Section

beglaubigt:
Ziegler

Installed condition

Figure A1:
Hilti metal expansion anchor HST2 V3 and HST2-F V3

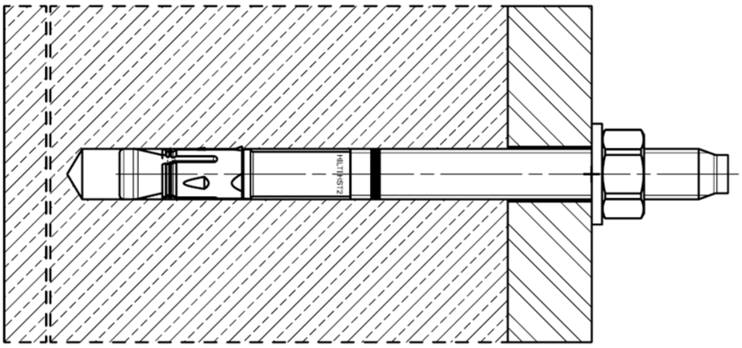


Figure A2:
Hilti metal expansion anchor HST2 V3 BW

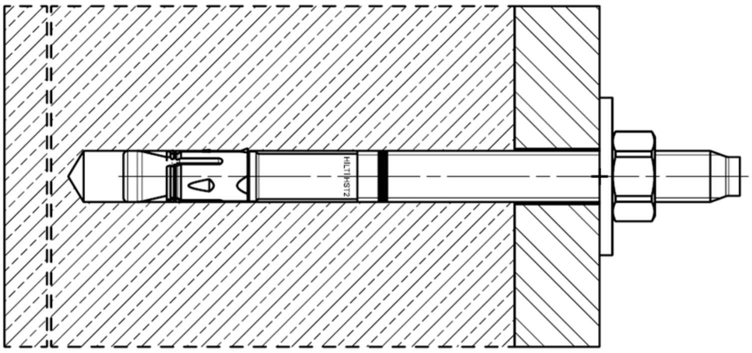
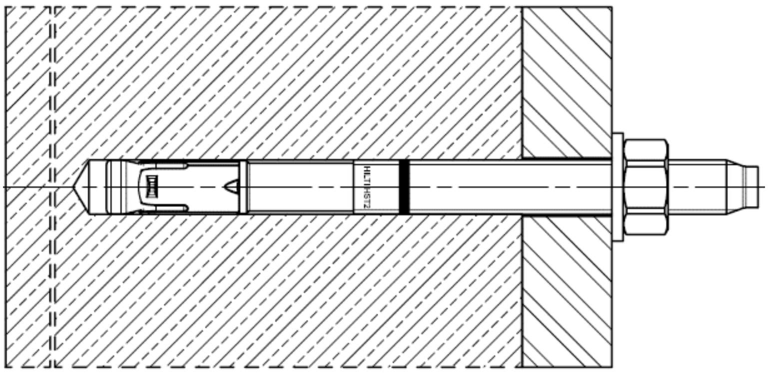


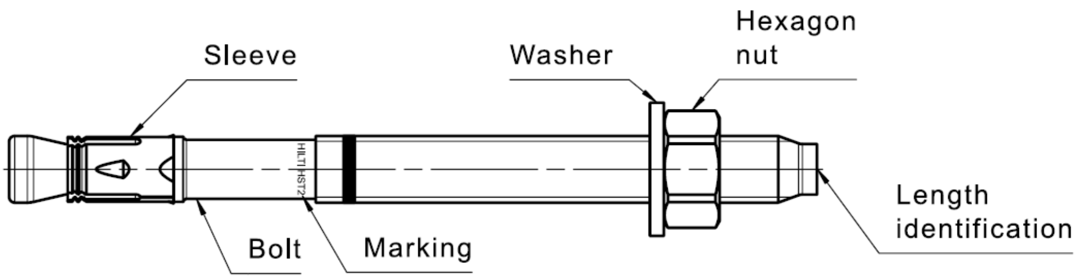
Figure A3:
Hilti metal expansion anchor HST2-R V3



Hilti metal expansion anchor HST2 V3	Annex A1
Product description Installation condition	

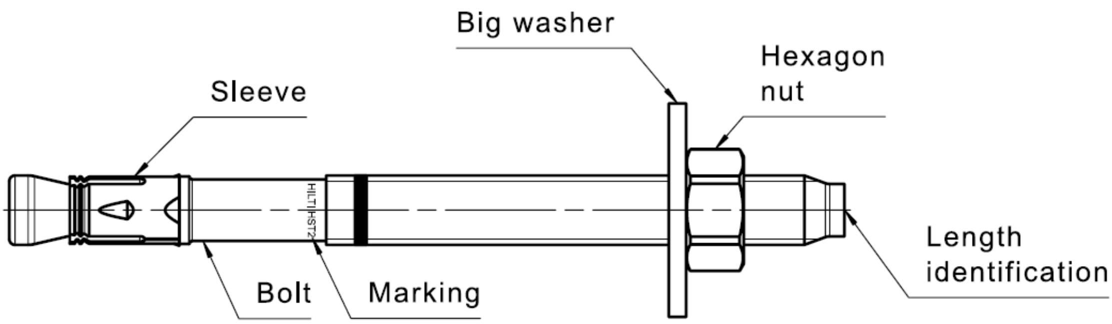
Product description and marking

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



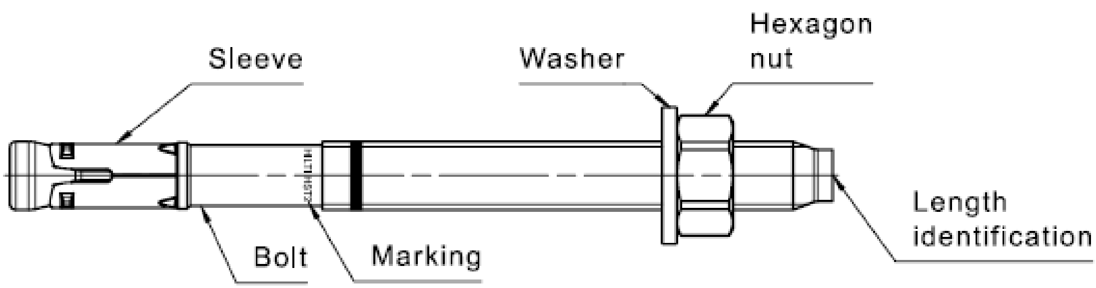
HST2 V3: HILTI HST2
HST2-F V3: HILTI HST2-F

Cold-formed version HST2 V3 BW: M8 to M16



HST2 V3 BW: HILTI HST2

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



HST2-R V3: HILTI HST2-R

Hilti metal expansion anchor HST2 V3	Annex A2
Product description Anchor types, marking and identification	

Table A1: Length identification

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

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

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

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

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

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

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

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

Table A2: Materials

Designation	Material
HST2 V3, HST2 V3 BW (Carbon steel, galvanized)	
Expansion sleeve	Stainless steel A2 according to ASTM A 240/A 240M: 2019
Bolt	Carbon steel, galvanized, coated, rupture elongation (l_0 = 5d) > 8 %
Washer	Carbon steel, galvanized
Hexagon nut	Carbon steel, galvanized, coated
HST2-F V3 (Carbon steel, hot dip galvanized ≥ 50µm according to EN ISO 10684:2004 + AC:2009)	
Expansion sleeve	Stainless steel A2 according to ASTM A 240/A 240M: 2019
Bolt	Carbon steel, hot dip galvanized, coated, rupture elongation (l_0 = 5d) > 8 %
Washer	Carbon steel, hot dip galvanized
Hexagon nut	Carbon steel, hot dip galvanized, coated
HST2-R V3 (Stainless steel A4 or Duplex stainless steel) Corrosion resistance class III according to EN 1993-1-4:2006+A1:2015	
Expansion sleeve	Stainless steel A4 according to EN 10088-1:2014
Bolt	Stainless steel A4 or Duplex stainless steel according to EN 10088-1:2014, cone coated, rupture elongation (l_0 = 5d) > 8 %
Washer	Stainless steel A4
Hexagon nut	Stainless steel A4, coated
Filling set (Carbon steel)	
Sealing / Spherical washer	Carbon steel, galvanized
Filling set (Carbon steel, mechanical zinc plating)	
Sealing washer and Spherical washer	Carbon steel, mechanical zinc plating
Filling Set (Stainless steel) Corrosion resistance class III according EN 1993-1-4:2006+A1:2015	
Sealing washer	Stainless steel A4 according to ASTM A 240/A 240M:2019
Spherical washer	Stainless steel A4 according to EN 10088-1:2014
Mortar	
Injection mortar	Injection mortar Hilti HIT-HY…

Hilti metal expansion anchor HST2 V3	Annex A4
Product description Materials	

Table A3: Material code for identification of different materials

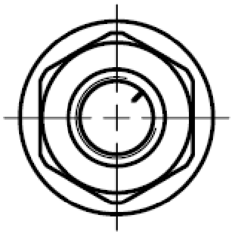
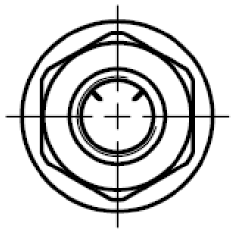
	HST2 V3, HST2-F V3, HST2 V3 BW	HST2-R V3
Material code	 Letter code with one mark	 Letter code with two marks

Table A4: Dimensions HST2 V3, HST2-F V3 and HST2 V3 BW

Size			**M8**	**M10**	**M12**	**M16**
Maximum length of anchor	l_{max}	[mm]	230	230	245	245
Shaft diameter at the cone	d_R	[mm]	5,65	6,94	8,22	12
Length of expansion sleeve	l_s	[mm]	13,6	18	19	24,6
Diameter of washer HST2 V3 and HST2-F V3	$d_W \geq$	[mm]	15,57	19,48	23,48	29,48
Diameter of washer HST2 V3 BW	$d_W \geq$	[mm]	23,48	29,48	43,38	49,38

HST2 V3, HST2-F V3 and HST2 V3 BW

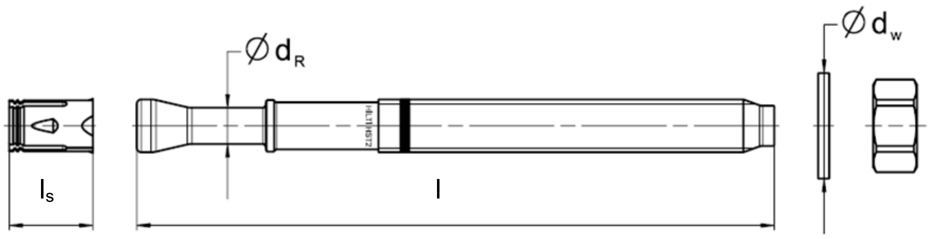
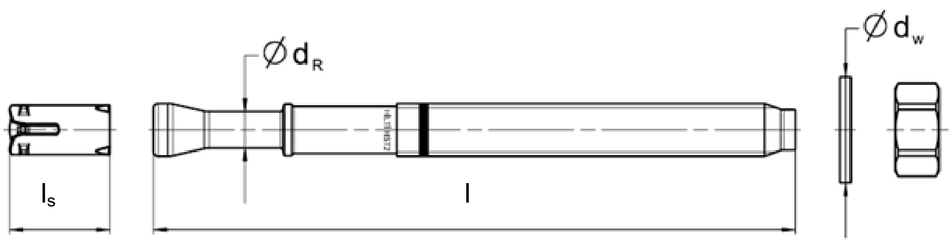


Table A5: Dimensions HST2-R V3

Size			**M8**	**M10**	**M12**	**M16**
Maximum length of anchor	l_{max}	[mm]	260	280	295	350
Shaft diameter at the cone	d_R	[mm]	5,6	7,3	8,6	11,6
Length of expansion sleeve	l_s	[mm]	14,8	18,3	22,6	24,4
Diameter of washer	$d_W \geq$	[mm]	15,57	19,48	23,48	29,48

HST2-R V3

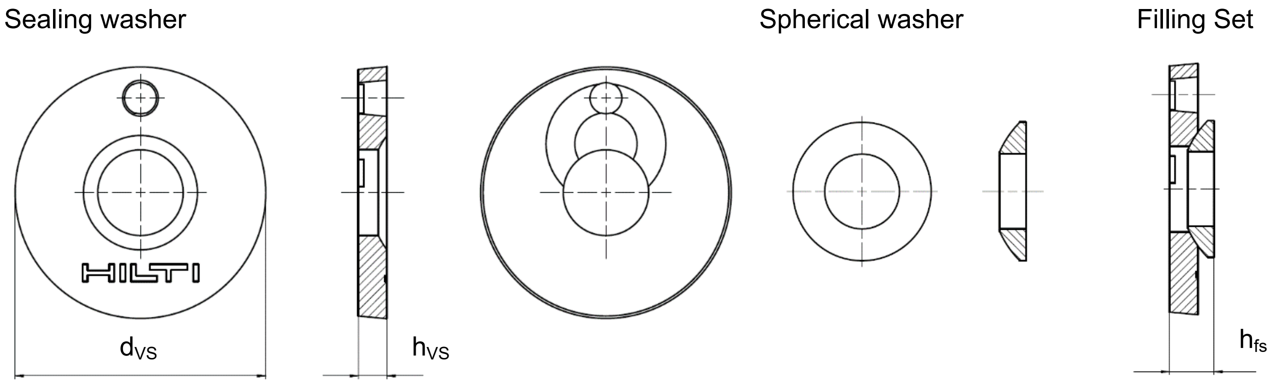


Hilti metal expansion anchor HST2 V3	Annex A6
Product description Dimensions	

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

Table A6: Dimensions of the Filling Set

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



Specifications of intended use

Anchorages subject to:

- Static and quasi-static loading: all sizes
- Seismic performance category C1 and C2: sizes see Table C4 – C9
- Fire exposure: all sizes.

Base materials:

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

Use conditions (Environmetal conditions):

- Structures subject to dry internal conditions (all materials).
- For all other conditions according to EN 1993-1-4:2006 + A1:2015 corresponding to corrosion resistance classes CRC according to Annex A4, Table A2 (stainless steel).

Design:

- Anchorages are designed under the responsibility of an engineer experienced in anchorages and concrete work.
- Verifiable calculation notes and drawings are prepared taking account of the loads to be anchored. The position of the anchor is indicated on the design drawings (e. g. position of the anchor relative to reinforcement or to supports, etc.).
- Anchorages are designed in accordance with: EN 1992-4:2018
- Under seismic loading 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 in this European Technical Assessment.
- In case of requirements to resistance to fire local spalling of the concrete cover must be avoided.
- For effective embedment depth h_{ef} < 40 mm the use is restricted to anchoring of statically indeterminate fixings (e.g. light weight suspended ceilings) under dry internal conditions only.

Installation:

- Anchor installation carried out by appropriately qualified personnel and under the supervision of the person responsible for technical matters of the site.
- Hole drilling and cleaning with the methods given on Annex B2
- The anchor may only be set once.
- Overhead applications are permitted.

Table B1: Specifications of intended use

Anchorages subject to:	**M8**	**M10**	**M12**	**M16**
Static and quasi static loading in cracked and uncracked concrete - hammer drilling and diamond coring	✓	✓	✓	✓
Seismic performance category C1 - hammer drilling	-	✓	✓	✓
Seismic performance category C2 - hammer drilling	-	✓	✓	✓
Fire exposure - hammer drilling and diamond coring	✓	✓	✓	✓

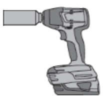
Table B2: Drilling technique

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

Table B3: Drill hole cleaning

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

Table B4: Methods for application of torque moment

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

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

Table B5: Installation parameters for HST2 V3, HST2-F V3 and HST2 V3 BW

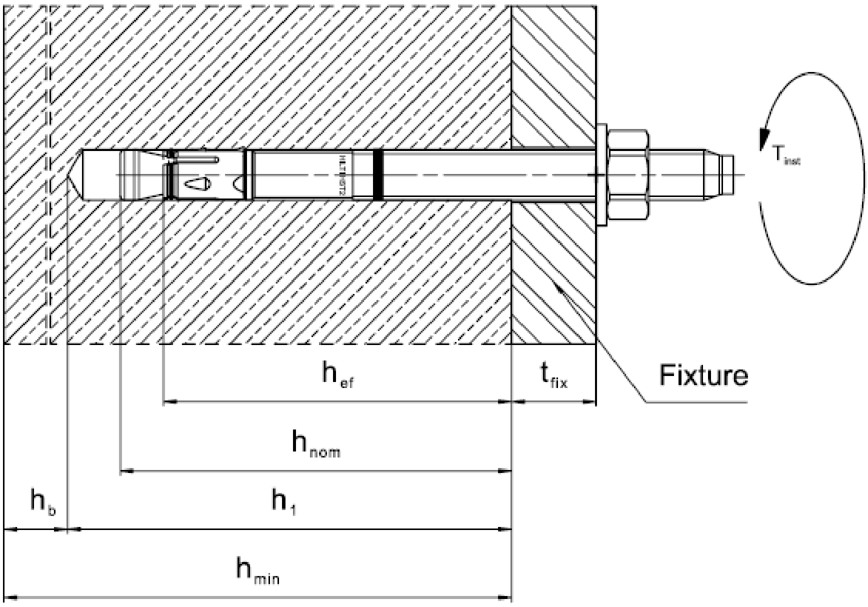
HST2 V3, HST2-F V3, HST2 V3 BW			**M8**	**M10**	**M12**	**M16**
Nominal diameter of drill bit	d_0	[mm]	8	10	12	16
Maximum cutting diameter of drill bit	d_{cut}	[mm]	8,45	10,45	12,50	16,50
Maximum diameter of clearance hole in the fixture	d_f	[mm]	9	12	14	18
Effective anchorage depth	h_{ef}	[mm]	30 -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

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

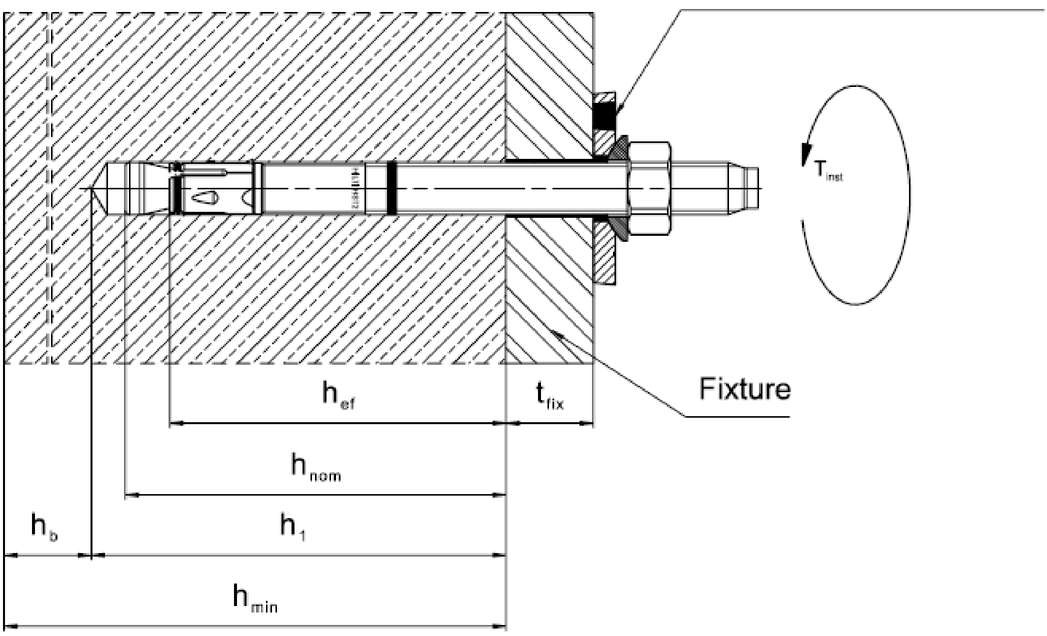
Hilti metal expansion anchor HST2 V3	Annex B3
Intended use Installation parameters	

Setting positions for HST2 V3, HST2-F V3, HST2 V3 BW

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



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



Hilti metal expansion anchor HST2 V3	Annex B4
Intended use Installation parameters	

Table B6: Installation parameters for HST2-R V3

HST2-R V3			**M8**	**M10**	**M12**	**M16**
Nominal diameter of drill bit	d_0	[mm]	8	10	12	16
Maximum cutting diameter of drill bit	d_{cut}	[mm]	8,45	10,45	12,50	16,50
Maximum diameter of clearance hole in the fixture	d_f	[mm]	9	12	14	18
Effective anchorage depth	h_{ef}	[mm]	30 - 70	40 - 80	50 - 100	65 - 120
Nominal embedment depth	h_{nom}	[mm]	h_{ef} + 8	h_{ef} + 9	h_{ef} + 10	h_{ef} + 13
Minimum depth of drill hole (hammer drilled, not cleaned)	$h_1 \geq$	[mm]	h_{ef} + 28	h_{ef} + 29	h_{ef} + 30	h_{ef} + 33
Minimum depth of drill hole (hammer drilled, cleaned)	$h_1 \geq$	[mm]	h_{ef} + 13	h_{ef} + 14	h_{ef} + 18	h_{ef} + 21
Minimum depth of drill hole (diamond cored boreholes)	$h_1 \geq$	[mm]	h_{ef} + 18	h_{ef} + 19	h_{ef} + 20	h_{ef} + 23
Minimum thickness of concrete member [1)]	$h_{min} \geq$	[mm]	max (100; $1{,}5 \cdot h_{ef}$)	max (120; $1{,}5 \cdot h_{ef}$)	max (140; $1{,}5 \cdot h_{ef}$)	max (160; $1{,}5 \cdot h_{ef}$)
Minimum concrete thickness below borehole bottom [1)]	$h_b \geq$	[mm]	21	27	32	34
Width across flats	SW	[mm]	13	17	19	24
Installation torque	T_{inst}	[Nm]	20	45	60	110

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

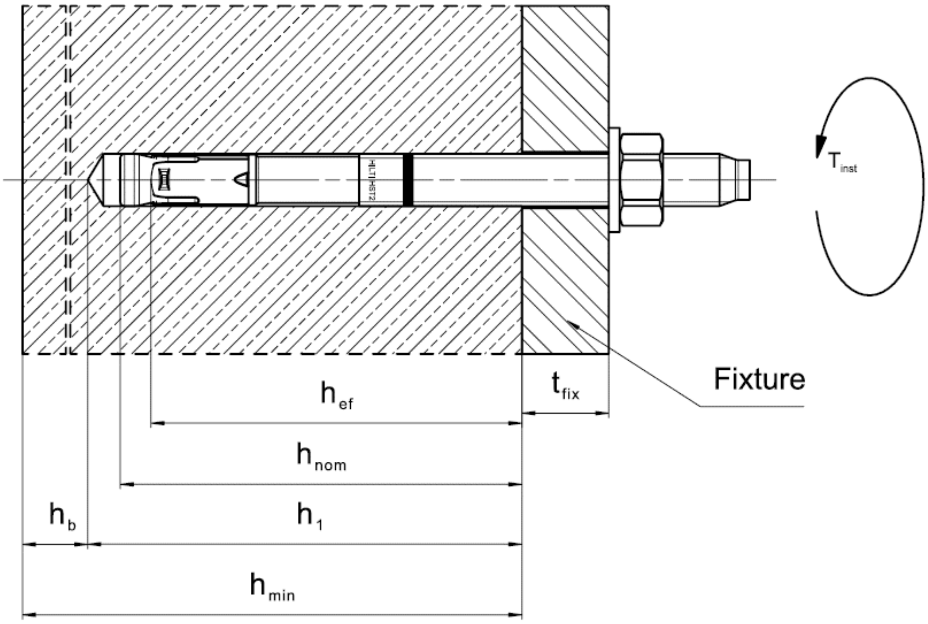
Hilti metal expansion anchor HST2 V3

Intended use
Installation parameters

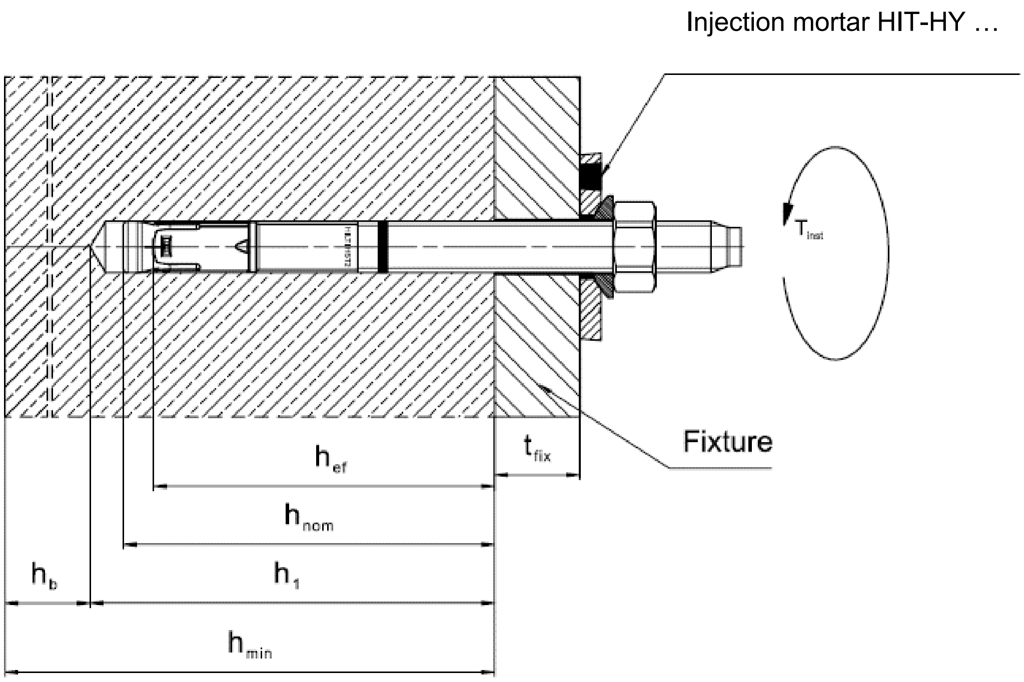
Annex B5

Setting positions for HST2-R V3

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



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

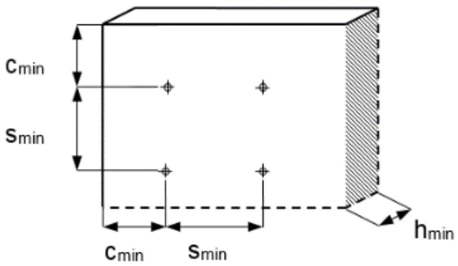


Hilti metal expansion anchor HST2 V3	Annex B6
Intended use Installation parameters	

Table B7: Minimum spacing and edge distance for HST2 V3, HST2-F V3 and HST2 V3 BW

			M8	M10	M12	M16
Minimum thickness of concrete member [1]	h_{min}	[mm]	max (100; $1{,}5 \cdot h_{ef}$)	max (120; $1{,}5 \cdot h_{ef}$)	max (140; $1{,}5 \cdot h_{ef}$)	max (160; $1{,}5 \cdot h_{ef}$)
Minimum spacing	s_{min}	[mm]	40	55	60	70
	for c ≥	[mm]	According to Table B9			
Minimum edge distance	c_{min}	[mm]	45	55	55	70
	for s ≥	[mm]	According to Table B9			
Cracked concrete						
Effective embedment depth	h_{ef}	[mm]	30 - 70	40 - 80	50 - 100	65 - 120
Required splitting area	$A_{sp,req}$	[mm²]	17100	26400	31000	44800
Uncracked concrete						
Effective embedment depth	h_{ef}	[mm]	30 - 70	40 - 80	50 - 100	65 - 120
Required splitting area	$A_{sp,req}$	[mm²]	19500	32000	38000	50100

[1] Under consideration of minimum concrete thickness below borehole bottom: $h_{min} \geq h_1 + h_b$ as given in Table B5



For the calculation of the minimum edge distance and spacing in combination with variable embedment depths and slab thickness the following equation must be fulfilled:

$A_{sp,ef} \geq A_{sp,req.}$

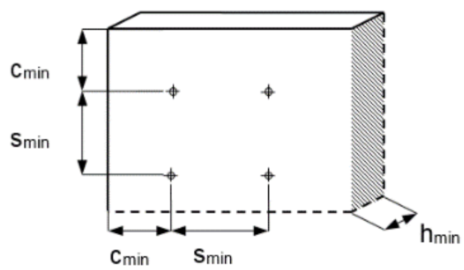
With:
$A_{sp,ef}$: Effective splitting area according to Table B9
$A_{sp,req.}$: Minimum required splitting area according to Table B7

Hilti metal expansion anchor HST2 V3	Annex B7
Intended Use Minimum spacing and minimum edge distance	

Table B8: Minimum spacing and edge distance for HST2-R V3

			M8	M10	M12	M16
Minimum thickness of concrete member	h_{min}	[mm]	max (100; $1{,}5 \cdot h_{ef}$)	max (120; $1{,}5 \cdot h_{ef}$)	max (140; $1{,}5 \cdot h_{ef}$)	max (160; $1{,}5 \cdot h_{ef}$)
Minimum spacing	s_{min}	[mm]	40	55	60	70
	for c ≥	[mm]	According to Table B9			
Minimum edge distance	c_{min}	[mm]	45	50	55	60
	for s ≥	[mm]	According to Table B9			
Cracked concrete						
Effective embedment depth	h_{ef}	[mm]	30 - 70	40 - 80	50 - 100	65 - 120
Minimum required splitting area	$A_{sp,req}$	[mm²]	18000	28800	36400	48700
Uncracked concrete						
Effective embedment depth	h_{ef}	[mm]	30 - 70	40 - 80	50 - 100	65 - 120
Minimum required splitting area	$A_{sp,req}$	[mm²]	21600	31800	42000	58250

[1)] Under consideration of minimum concrete thickness below borehole bottom: $h_{min} \geq h_1 + h_b$ as given in Table B6



For the calculation of the minimum edge distance and spacing in combination with variable embedment depths and slab thickness the following equation must be fulfilled:

$A_{sp,ef} \geq A_{sp,req.}$

With:

$A_{sp,ef}$: Effective splitting area according to Table B9

$A_{sp,req.}$: Minimum required splitting area according to Table B8

Hilti metal expansion anchor HST2 V3	Annex B8
Intended Use Minimum spacing and minimum edge distance	

Table B9: Effective splitting area $A_{sp,ef}$ [1)]

Effective splitting area $A_{sp,ef}$ [1)] for a concrete member thickness $h > h_{ef} + 1{,}5 \cdot c$ and $h \geq h_{min}$			
Single anchor and anchor groups (for $c \geq c_{min}$) with	$s > 3 \cdot c$ $h_{ef} < 1{,}5 \cdot c$	$A_{sp,ef} = (6 \cdot c) \cdot (h_{ef} + 1{,}5 \cdot c)$	[mm²]
Anchor groups (for $c \geq c_{min}$, $s \geq s_{min}$) with	$s \leq 3 \cdot c$ $h_{ef} < 1{,}5 \cdot c$	$A_{sp,ef} = (3 \cdot c + s) \cdot (h_{ef} + 1{,}5 \cdot c)$	[mm²]
Single anchor and anchor groups (for $c \geq c_{min}$) with	$s > 3 \cdot c$ $h_{ef} \geq 1{,}5 \cdot c$	$A_{sp,ef} = (6 \cdot c) \cdot (3 \cdot c)$	[mm²]
Anchor groups (for $c \geq c_{min}$, $s \geq s_{min}$) with	$s \leq 3 \cdot c$ $h_{ef} \geq 1{,}5 \cdot c$	$A_{sp,ef} = (3 \cdot c + s) \cdot (3 \cdot c)$	[mm²]
Effective splitting area $A_{sp,ef}$ [1)] for a concrete member thickness $h \leq h_{ef} + 1{,}5 \cdot c$ and $h \geq h_{min}$			
Single anchor and anchor groups (for $c \geq c_{min}$) with	$s > 3 \cdot c$ $h_{ef} < 1{,}5 \cdot c$	$A_{sp,ef} = (6 \cdot c) \cdot h$	[mm²]
Anchor groups (for $c \geq c_{min}$, $s \geq s_{min}$) with	$s \leq 3 \cdot c$ $h_{ef} < 1{,}5 \cdot c$	$A_{sp,ef} = (3 \cdot c + s) \cdot h$	[mm²]
Single anchor and anchor groups (for $c \geq c_{min}$) with	$s > 3 \cdot c$ $h_{ef} \geq 1{,}5 \cdot c$	$A_{sp,ef} = (6 \cdot c) \cdot (h - h_{ef} + 1{,}5 \cdot c)$	[mm²]
Anchor groups (for $c \geq c_{min}$, $s \geq s_{min}$) with	$s \leq 3 \cdot c$ $h_{ef} \geq 1{,}5 \cdot c$	$A_{sp,ef} = (3 \cdot c + s) \cdot (h - h_{ef} + 1{,}5 \cdot c)$	[mm²]

[1)] Edge distance and spacing must be rounded up in 5 mm increments

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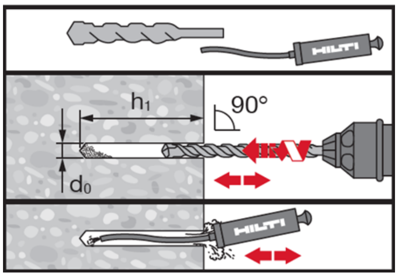
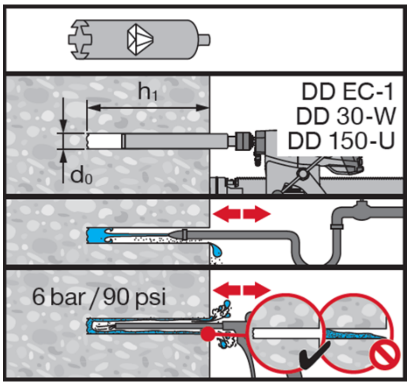
Installation instruction

Hole drilling and cleaning

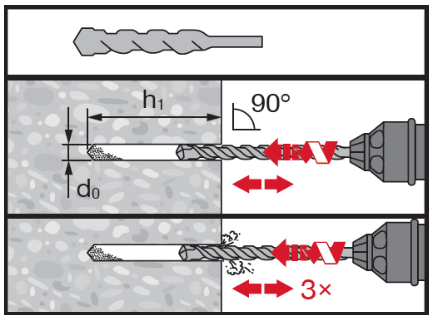
a) Hammer drilling (HD):
M8 to M16



b) Diamond coring (DD):
M8 to M16

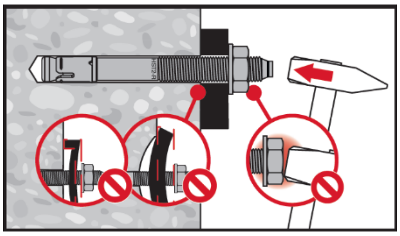


c) Hammer drilling non-cleaned (HD NC): M8 to M16

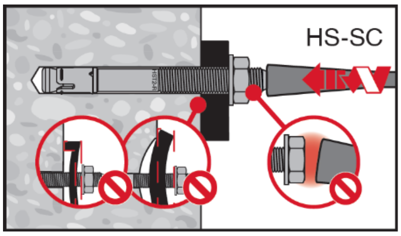


Anchor setting

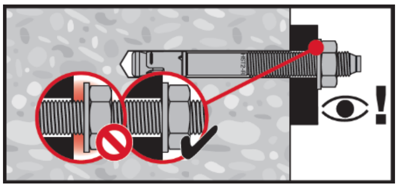
a) Hammer setting:
M8 to M16



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

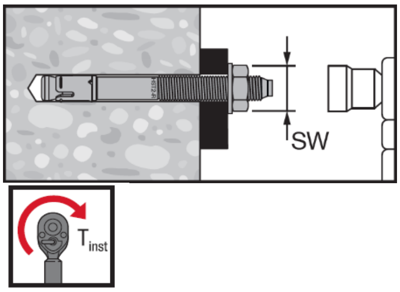


Check setting

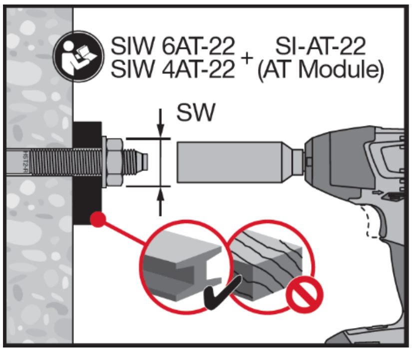


Anchor torqueing

a) Torque wrench:
M8 to M16



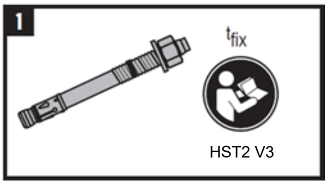
b) Machine torqueing:
M8 to M16

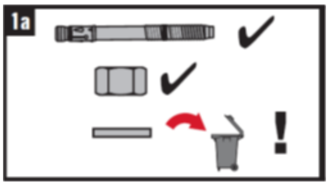


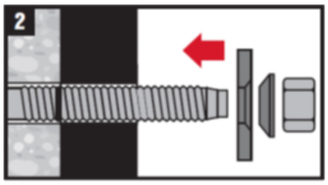
Hilti metal expansion anchor HST2 V3	Annex B10
Intended Use Installation instructions	

Installation with Filling Set

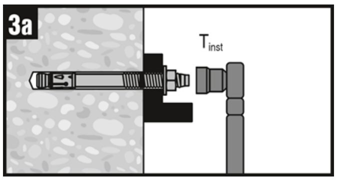
Installation of sealing washer

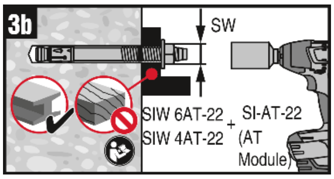




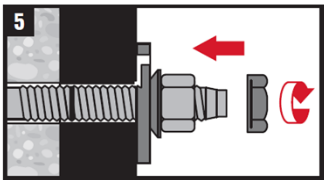


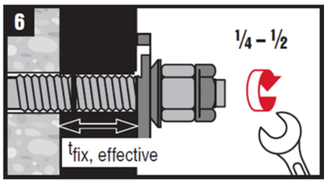
Anchor torqueing



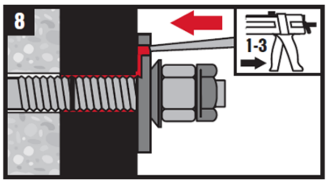


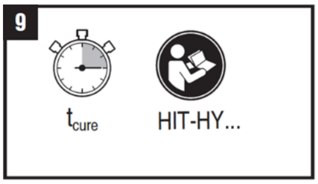
Installation of counter nut (optional)





Injection of mortar





Hilti metal expansion anchor HST2 V3	Annex B11
Intended Use Installation instructions	

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

			M8	M10	M12	M16
Effective anchorage depth	h_{ef}	[mm]	30 - 70	40 - 80	50 - 100	65 - 120
Steel failure						
HST2 V3, HST2-F V3 and HST2 V3 BW						
Characteristic resistance	$N_{Rk,s}$	[kN]	16,5	28,0	41,4	82,6
Partial factor	$\gamma_{Ms,N}$ 1)	[-]	1,40			
HST2-R V3						
Characteristic resistance	$N_{Rk,s}$	[kN]	17,6	30,5	43,1	78,2
Partial factor	$\gamma_{Ms,N}$ 1)	[-]	1,40			
Pull-out failure						
HST2 V3, HST2-F V3 and HST2 V3 BW with Hammer drilling						
Cracked concrete C20/25						
Effective embedment depth	h_{ef}	[mm]	30 - 70	40 - 80	50 - 100	65 - 120
Characteristic resistance	$N_{Rk,p,cr}$	[kN]	Min(0,1333·h_{ef} +1,0; 7,0)	Min(11,0; $N^0_{Rk,c}$ 2))	Min(14,0; $N^0_{Rk,c}$ 2))	Min(25,0; $N^0_{Rk,c}$ 2))

1) In absence of other national regulations

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

Table C1: Continued

			M8	M10	M12	M16
Uncracked concrete C20/25						
Effective embedment depth	$h_{ef,1}$	[mm]	30 - 40	40 - 50	50 - 65	65 - 80
Characteristic resistance	$N_{Rk,p,ucr}$	[kN]	Min(12,4; $N^0_{Rk,c}$ 1))	Min(0,2555·h_{ef} +2,2254; 15,0)	Min(0,5072·h_{ef} -7,9657; 25,0)	Min(0,5480·h_{ef} -9,8416; 34,0)
Effective embedment depth	$h_{ef,2}$	[mm]	41 - 70	51 - 80	66 - 100	81 - 120
Characteristic resistance	$N_{Rk,p,ucr}$	[kN]	Min(0,1185·h_{ef} +7,7052; 16,0)	Min(0,3·h_{ef}; 24,0)	Min(0,2571·h_{ef} +8,2857; 34,0)	Min(0,25·h_{ef} +14,0; 44,0)
HST2 V3, HST2-F V3 and HST2 V3 BW with Diamond coring						
Cracked concrete C20/25						
Effective embedment depth	$h_{ef,1}$	[mm]	30 - 70	40 - 80	50 - 100	65 - 120
Characteristic resistance	$N_{Rk,p,cr}$	[kN]	Min(0,1333·h_{ef} +1,0; 7,0)	Min(0,2857·h_{ef} -4,4286; 9,0)	Min(0,4·h_{ef} -10,0; 12,0)	Min(0,3529·h_{ef} -8,9412; 20,0)
Uncracked concrete C20/25						
Effective embedment depth	$h_{ef,1}$	[mm]	30 - 40	40 - 50	50 - 65	65 - 80
Characteristic resistance	$N_{Rk,p,ucr}$	[kN]	Min(0,4·h_{ef} -6,0; 10,0)	Min(0,3·h_{ef} -2,0; 13,0)	Min(0,5072·h_{ef} -7,9657; 25,0)	Min(0,5480·h_{ef} -9,8416; 34,0)
Effective embedment depth	$h_{ef,2}$	[mm]	41 - 70	51 - 80	66 - 100	81 - 120
Characteristic resistance	$N_{Rk,p,ucr}$	[kN]	Min(0,1·h_{ef} +6,0; 13,0)·	Min(0,2333· h_{ef} +1,3333; 20,0)	Min(0,2571· h_{ef} +8,2857; 34,0)	Min(0,25· h_{ef} +14,0; 44,0)

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

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

Table C1: Continued

			M8	M10	M12	M16
HST2-R V3 with Hammer drilling						
Cracked concrete C20/25						
Effective embedment depth	h_{ef}	[mm]	30 - 70	40 - 80	50 - 100	65 - 120
Characteristic resistance	$N_{Rk,p,cr}$	[kN]	5,0	9,0	12,0	25,0
Uncracked concrete C20/25						
Effective embedment depth	$h_{ef,1}$	[mm]	30 - 40	40 - 50	50 - 65	65 - 80
Characteristic resistance	$N_{Rk,p,ucr}$	[kN]	Min(12,4; $N^0_{Rk,c}$[1]))	Min(0,2555·h_{ef} +2,2254; 15,0)	Min(25,8; $N^0_{Rk,c}$[1]))	Min(35,2; $N^0_{Rk,c}$[1]))
Effective embedment depth	$h_{ef,2}$	[mm]	41 - 70	51 - 80	66 - 100	81 - 120
Characteristic resistance	$N_{Rk,p,ucr}$	[kN]	Min(0,1185·h_{ef} +7,7052; 16,0)	Min(0,3333·h_{ef} -1,6667; 25,0)	Min(0,2634·h_{ef} +8,6563; 35,0)·	Min(0,27·h_{ef} +13,6; 46,0)
HST2-R V3 with Diamond coring						
Cracked concrete C20/25						
Effective embedment depth	h_{ef}	[mm]	30 - 70	40 - 80	50 - 100	65 - 120
Characteristic resistance	$N_{Rk,p,cr}$	[kN]	5,0	9,0	12,0	25,0
Uncracked concrete C20/25						
Effective embedment depth	$h_{ef,1}$	[mm]	30 - 40	40 - 50	50 - 65	65 - 80
Characteristic resistance	$N_{Rk,p,ucr}$	[kN]	Min(0,4·h_{ef} -6,0; 10,0)	Min(0,2·h_{ef} +2,0; 12,0)	Min(0,4·h_{ef} -6,0; 20,0)	Min(0,5333·h_{ef} -14,6667; 28,0)
Effective embedment depth	$h_{ef,2}$	[mm]	41 - 70	51 - 80	66 - 100	81 - 120
Characteristic resistance	$N_{Rk,p,ucr}$	[kN]	Min(0,0667·h_{ef} +7,3333; 12,0)	Min(0,2667·h_{ef} -1,3333; 20,0)	Min(0,2286·h_{ef} +5,1429; 28,0)	Min(0,2·h_{ef} +12,0; 36,0)
HST2 V3, HST2-F V3, HST2-R V3 and HST2 V3 BW						
Increasing factor for $N_{Rk,p}$ (cr and ucr concrete) $\psi_c = (f_{ck}/20)^{0,5}$	ψ_c	C30/37	1,22			
	ψ_c	C40/50	1,41			
	ψ_c	C50/60	1,58			

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

Hilti metal expansion anchor HST2 V3	Annex C3
Performances Characteristic resistance under tension load	

Table C1 continued

			M8	M10	M12	M16
Concrete cone failure and Splitting failure						
Installation factor	γ_{inst}	[-]	1,0			
Effective embedment depth	h_{ef}	[mm]	30 - 70	40 - 80	50 - 100	65 - 120
Factor for cracked concrete	$k_1 = k_{cr,N}$	[-]	7,7			
Factor for uncracked concrete	$k_1 = k_{ucr,N}$	[-]	11,0			
Spacing	$s_{cr,N}$	[mm]	$3\ h_{ef}$			
Edge distance	$c_{cr,N}$	[mm]	$1,5\ h_{ef}$			
Characteristic resistance	$N^0_{Rk,sp}$	[kN]	Min ($N_{Rk,p}$; $N^0_{Rk,c}$) 1)			
Splitting area required to determine $c_{cr,sp}$	A_{rqd}	[mm²]	($N^0_{Rk,sp,C20}$ - b) / a 2)			
HST2 V3, HST2-F V3 and HST2 V3 BW						
Calculation factor for A_{rqd}	b	[-]	-9,058	2,543	3,0415	11,556
Calculation factor for A_{rqd}	a	[-]	0,0008	0,0003	0,0004	0,0003
HST2-R V3						
Calculation factor for A_{rqd}	b	[-]	2,079	1,471	-2,756	-4,469
Calculation factor for A_{rqd}	a	[-]	0,0003	0,0004	0,0005	0,0004
Spacing (splitting)	$s_{cr,sp}$	[mm]	$2 \cdot c_{cr,sp}$			
Edge distance (splitting) 3)	$c_{cr,sp}$	[mm]	MIN [(A_{rqd} + 0,8 · (h_{min} – h_{ef})²) / (3,41 · h_{min} – 0,59 · h_{ef}); A_{rqd} / (h_{min} · $8^{0,5}$)] ≥ (1,5 · h_{ef}) 4)			

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

2) $N^0_{Rk,sp,C20}$ in kN, calculated for C20/25 uncracked concrete

3) h_{min} = minimum member thickness (refer Table B5 and B6), under consideration $h_{min} \leq 4 \cdot h_{ef}$

4) $c_{cr,sp} \geq (1,5 \cdot h_{ef})$ if concrete cone failure is decisive on the evaluation of the $N^0_{Rk,sp}$

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

			M8	M10	M12	M16
Effective embedment depth	h_{ef}	[mm]	30 - 70	40 - 80	50 - 100	65 - 120
Steel failure without lever arm						
HST2 V3, HST2-F V3 and HST2 V3 BW						
Characteristic resistance	$V^0_{Rk,s}$	[kN]	10,6	18,9	29,5	51,0
Characteristic resistance using Filling Set	$V^0_{Rk,s}$	[kN]	10,6	18,9	29,5	51,0
Partial factor	$\gamma_{Ms,V}$ [1]	[-]	1,25			
Ductility factor	k_7	[-]	1,0			
HST2-R V3						
Characteristic resistance	$V^0_{Rk,s}$	[kN]	15,7	25,3	36,7	63,6
Characteristic resistance using Filling Set	$V^0_{Rk,s}$	[kN]	15,7	25,3	36,7	63,6
Partial factor	$\gamma_{Ms,V}$ [1]	[-]	1,25			
Ductility factor	k_7	[-]	1,0			
Steel failure with lever arm						
HST2 V3, HST2-F V3 and HST2 V3 BW						
Characteristic resistance	$M^0_{Rk,s}$	[Nm]	21,7	48,6	91,7	216
Partial factor	$\gamma_{Ms,V}$ [1]	[-]	1,25			
HST2-R V3						
Characteristic resistance	$M^0_{Rk,s}$	[Nm]	27	53	93	216
Partial factor	$\gamma_{Ms,V}$ [1]	[-]	1,25			
Concrete pry-out failure						
HST2 V3, HST2-F V3 HST2 V3 BW and HST2-R V3						
Pryout factor	k_8	[-]	2,34	2,55	2,57	2,82
Installation factor	γ_{inst}	[-]	1,00			
Concrete edge failure						
HST2 V3, HST2-F V3 HST2 V3 BW and HST2-R V3						
Effective length of anchor in shear loading	$l_f = h_{ef}$	[mm]	30 - 70	40 - 80	50 - 100	65 - 120
Diameter of anchor	d_{nom}	[mm]	8	10	12	16
Installation factor	γ_{inst}	[-]	1,00			

[1] In absence of other national regulations

Hilti metal expansion anchor HST2 V3	Annex C5
Performances Characteristic resistance under shear load	

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

			M8	M10	M12	M16
Displacements under tension loading						
HST2 V3, HST2-F V3, HST2 V3 BW						
Effective anchorage depth	h_{ef}	[mm]	30 - 70	40 - 80	50 - 100	65 - 120
Tension load in cracked concrete	N	[kN]	3,3	5,2	6,7	11,9
Corresponding displacement	δ_{N0}	[mm]	1,11	1,18	0,77	2,20
	$\delta_{N\infty}$	[mm]	1,70	1,28	1,73	1,13
Tension load in uncracked concrete	N	[kN]	7,6	11,4	16,2	21,0
Corresponding displacement	δ_{N0}	[mm]	0,96	0,31	2,17	2,07
	$\delta_{N\infty}$	[mm]	1,70	1,28	1,73	1,13
HST2-R V3						
Effective anchorage depth	h_{ef}	[mm]	30 - 70	40 - 80	50 - 100	65 - 120
Tension load in cracked concrete	N	[kN]	2,4	4,3	5,7	11,9
Corresponding displacement	δ_{N0}	[mm]	0,6	0,2	0,8	1,0
	$\delta_{N\infty}$	[mm]	1,09	1,33	1,06	1,2
Tension load in uncracked concrete	N	[kN]	7,6	11,9	16,7	21,9
Corresponding displacement	δ_{N0}	[mm]	2,17	1,76	0,95	4,1
	$\delta_{N\infty}$	[mm]	1,09	1,33	1,06	1,2
Displacements under shear loading						
HST2 V3, HST2-F V3, HST2 V3 BW						
Effective anchorage depth	h_{ef}	[mm]	30 - 70	40 - 80	50 - 100	65 - 120
Shear load in cracked and uncracked concrete	V	[kN]	6,1	10,8	16,9	29,1
Corresponding displacement	δ_{V0}	[mm]	2,28	2,28	2,21	2,41
	$\delta_{V\infty}$	[mm]	3,42	3,42	3,32	3,62
HST2-R V3						
Effective anchorage depth	h_{ef}	[mm]	30 - 70	40 - 80	50 - 100	65 - 120
Shear load in cracked and uncracked concrete	V	[kN]	9,0	14,5	21,0	36,3
Corresponding displacement	δ_{V0}	[mm]	1,9	4,3	6,0	2,9
	$\delta_{V\infty}$	[mm]	2,9	6,4	9,1	4,4

Hilti metal expansion anchor HST2 V3

Performances
Displacements

Annex C6

Table C4: Characteristic values of resistance under tension load in case of seismic performance category C1

			M10	M12	M16
Effective embedment depth	h_{ef}	[mm]	60	70	85
Steel failure					
HST2 V3, HST2-F V3 and HST2 V3 BW					
Characteristic resistance	$N_{Rk,s,C1}$	[kN]	28,0	41,4	82,6
Partial safety factor	$\gamma_{Ms,C1}$ [1)]	[-]		1,40	
HST2-R V3					
Characteristic resistance	$N_{Rk,s,C1}$	[kN]	30,5	43,1	78,2
Partial safety factor	$\gamma_{Ms,C1}$ [1)]	[-]		1,40	
Pullout failure					
HST2 V3, HST2-F V3 and HST2 V3 BW					
Characteristic resistance	$N_{Rk,p,C1}$	[kN]	11,0	14,0	22,7
HST2-R V3					
Characteristic resistance	$N_{Rk,p,C1}$	[kN]	8,0	10,7	18,0
Concrete cone failure [2)]					
HST2 V3, HST2-F V3, HST2-R V3 and HST2 V3 BW					
Installation factor	γ_{inst}	[-]		1,00	
Splitting failure [2)]					
HST2 V3, HST2-F V3, HST2-R V3 and HST2 V3 BW					
Installation factor	γ_{inst}	[-]		1,00	

[1)] In absence of other national regulations

[2)] For concrete cone failure and splitting failure see EN 1992-4:2018

Table C5: Characteristic values of resistance under shear load in case of seismic performance category C1

			M10	M12	M16
Effective embedment depth	h_{ef}	[mm]	60	70	85
Steel failure					
HST2 V3, HST2-F V3 and HST2 V3 BW					
Characteristic resistance	$V_{Rk,s,C1}$	[kN]	11,9	21,4	39,7
Partial factor	$\gamma_{Ms,C1}$ 1)	[-]		1,25	
HST2-R V3					
Characteristic resistance	$V_{Rk,s,C1}$	[kN]	13,6	23,1	37,5
Partial factor	$\gamma_{Ms,C1}$ 1)	[-]		1,25	
Concrete pryout failure 2)					
HST2 V3, HST2-F V3, HST2-R V3 and HST2 V3 BW					
Installation factor	γ_{inst}	[-]		1,00	
Concrete edge failure 2)					
HST2 V3, HST2-F V3, HST2-R V3 and HST2 V3 BW					
Installation factor	γ_{inst}	[-]		1,00	

1) In absence of other national regulations

2) For concrete pryout failure and concrete edge failure see EN 1992-4:2018

Hilti metal expansion anchor HST2 V3	Annex C8
Performances Characteristic shear resistance for seismic performance category C1	

Table C6: Characteristic values of resistance under tension load in case of seismic performance category C2

			M10	M12	M16
Effective embedment depth	h_{ef}	[mm]	60	70	85
Steel failure					
HST2 V3, HST2-F V3 and HST2 V3 BW					
Characteristic resistance	$N_{Rk,s,C2}$	[kN]	28,0	41,4	82,6
Partial factor	$\gamma_{Ms,C2}$ [1)]	[-]		1,40	
HST2-R V3					
Characteristic resistance	$N_{Rk,s,C2}$	[kN]	30,5	43,1	78,2
Partial factor	$\gamma_{Ms,C2}$ [1)]	[-]		1,40	
Pullout failure					
HST2 V3, HST2-F V3 and HST2 V3 BW					
Characteristic resistance	$N_{Rk,p,C2}$	[kN]	5,5	14,0	18,0
HST2-R V3					
Characteristic resistance	$N_{Rk,p,C2}$	[kN]	3,3	10,0	12,8
Concrete cone failure [2)]					
HST2 V3, HST2-F V3, HST2-R V3 and HST2 V3 BW					
Installation factor	γ_{inst}	[-]		1,00	
Splitting failure [2)]					
HST2 V3, HST2-F V3, HST2-R V3 and HST2 V3 BW					
Installation factor	γ_{inst}	[-]		1,00	

[1)] In absence of other national regulations

[2)] For concrete pryout failure and concrete edge failure see EN 1992-4:2018

Table C7: Displacements under tension loads for seismic performance category C2

			M10	M12	M16
Effective embedment depth	h_{ef}	[mm]	60	70	85
Displacements under tension loading					
HST2 V3, HST2-F V3 and HST2 V3 BW					
Displacement DLS	$\delta_{N,C2}$	[mm]	3,55	5,21	5,25
Displacement ULS	$\delta_{N,C2}$	[mm]	13,56	14,93	15,77
HST2-R					
Displacement DLS	$\delta_{N,C2}$	[mm]	1,4	6,7	4,0
Displacement ULS	$\delta_{N,C2}$	[mm]	8,6	15,9	13,3

Table C8: Characteristic shear resistance for seismic performance category C2

			M10	M12	M16
Effective embedment depth	h_{ef}	[mm]	60	70	85
Steel failure					
HST2 V3, HST2-F V3 and HST2 V3 BW					
Characteristic resistance	$V_{Rk,s,C2}$	[kN]	7,4	11,1	25,0
Partial factor	$\gamma_{Ms,C2}$ [1]	[-]		1,25	
HST2-R V3					
Characteristic resistance	$V_{Rk,s,C2}$	[kN]	12,0	18,0	37,5
Partial factor	$\gamma_{Ms,C2}$ [1]	[-]		1,25	
Concrete pryout failure [2]					
HST2 V3, HST2-F V3, HST2-R V3 and HST2 V3 BW					
Installation factor	γ_{inst}	[-]		1,00	
Concrete edge failure [2]					
HST2 V3, HST2-F V3, HST2-R V3 and HST2 V3 BW					
Installation factor	γ_{inst}	[-]		1,00	

[1] In absence of other national regulations

[2] For concrete pryout failure and concrete edge failure see EN 1992-4:2018

Table C9: Displacements under shear loads for seismic performance category C2

			M10	M12	M16
Effective embedment depth	h_{ef}	[mm]	60	70	85
Displacements under shear loading					
HST2 V3, HST2-F V3, HST2 V3 BW					
Displacement DLS	$\delta_{V,C2}$	[mm]	4,53	4,18	4,42
Displacement ULS	$\delta_{V,C2}$	[mm]	6,21	5,89	6,68
HST2-R V3					
Displacement DLS	$\delta_{V,C2}$	[mm]	4,2	5,3	5,7
Displacement ULS	$\delta_{V,C2}$	[mm]	7,5	7,9	8,9

Table C10: Characteristic tension resistance under fire exposure for HST2 V3, HST2-F V3 and HST2 V3 BW in cracked and uncracked concrete

				M8	M10	M12	M16
Steel failure							
HST2 V3, HST2-F V3 and HST2 V3 BW							
Effective embedment depth		$h_{ef,1}$	[mm]	30 - 44	40 - 59	50 - 69	65 - 84
Characteristic resistance	R30	$N_{Rk,s,fi}$	[kN]	0,4	0,9	1,7	3,1
	R60	$N_{Rk,s,fi}$	[kN]	0,3	0,8	1,3	2,4
	R90	$N_{Rk,s,fi}$	[kN]	0,3	0,6	1,1	2,0
	R120	$N_{Rk,s,fi}$	[kN]	0,2	0,5	0,8	1,6
Effective embedment depth		$h_{ef,2}$	[mm]	45 - 70	60 - 80	70 - 100	85 - 120
Characteristic resistance	R30	$N_{Rk,s,fi}$	[kN]	1,2	2,6	4,8	9,0
	R60	$N_{Rk,s,fi}$	[kN]	1,0	2,1	3,8	7,0
	R90	$N_{Rk,s,fi}$	[kN]	0,8	1,5	2,7	5,0
	R120	$N_{Rk,s,fi}$	[kN]	0,6	1,2	2,1	4,0
Pullout failure							
Effective embedment depth		h_{ef}	[mm]	30 - 70	40 - 80	50 - 100	65 - 120
Characteristic resistance in concrete ≥ C20/25	R30	$N_{Rk,p,fi}$	[kN]	$0{,}25 \cdot N_{Rk,p}$ [1)]			
	R60	$N_{Rk,p,fi}$	[kN]				
	R90	$N_{Rk,p,fi}$	[kN]				
	R120	$N_{Rk,p,fi}$	[kN]	$0{,}20 \cdot N_{Rk,p}$ [1)]			

[1)] $N_{Rk,p}$ is the characteristic resistance for pull-out failure $N_{Rk,p,cr}$ (see Table C1) in cracked concrete C20/25 under ambient temperature

Table C10: Continued

				M8	M10	M12	M16
Concrete cone failure							
HST2 V3, HST2-F V3 and HST2 V3 BW							
Effective embedment depth		h_{ef}	[mm]	30 - 70	40 - 80	50 - 100	65 - 120
Characteristic resistance in concrete ≥ C20/25	R30	$N^0_{Rk,c,fi}$	[kN]	$h_{ef} / 200 \cdot N^0_{Rk,c} \leq N^0_{Rk,c}$			
	R60	$N^0_{Rk,c,fi}$	[kN]				
	R90	$N^0_{Rk,c,fi}$	[kN]				
	R120	$N^0_{Rk,c,fi}$	[kN]	$0{,}8 \cdot h_{ef} / 200 \cdot N^0_{Rk,c} \leq N^0_{Rk,c}$			
Spacing		$s_{cr,N}$	[mm]	4 h_{ef}			
		s_{min}	[mm]	40	55	60	70
Edge distance		$c_{cr,N}$	[mm]	2 h_{ef}			
		c_{min}	[mm]	Fire attack from one side: 2 h_{ef} Fire attack from more than one side: ≥ 300			

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

Table C11: Characteristic tension resistance under fire exposure for Hilti metal expansion anchor HST2-R V3 in cracked and uncracked concrete

				M8	M10	M12	M16
Steel failure							
HST2-R V3							
Effective embedment depth		$h_{ef,1}$	[mm]	30 - 44	40 - 59	50 - 69	65 - 84
Characteristic resistance	R30	$N_{Rk,s,fi}$	[kN]	0,4	0,9	1,7	3,1
	R60	$N_{Rk,s,fi}$	[kN]	0,3	0,8	1,3	2,4
	R90	$N_{Rk,s,fi}$	[kN]	0,3	0,6	1,1	2,0
	R120	$N_{Rk,s,fi}$	[kN]	0,2	0,5	0,8	1,6
Effective embedment depth		$h_{ef,2}$	[mm]	45 - 70	60 - 80	70 - 100	85 - 120
Characteristic resistance	R30	$N_{Rk,s,fi}$	[kN]	0,9	2,5	5,0	9,0
	R60	$N_{Rk,s,fi}$	[kN]	0,7	1,5	3,5	6,0
	R90	$N_{Rk,s,fi}$	[kN]	0,6	1,0	2,0	3,5
	R120	$N_{Rk,s,fi}$	[kN]	0,5	0,7	1,0	2,0
Pullout failure							
Effective embedment depth		h_{ef}	[mm]	30 - 70	40 - 80	50 - 100	65 - 120
Characteristic resistance in concrete ≥ C20/25	R30	$N_{Rk,p,fi}$	[kN]	$0{,}25 \cdot N_{Rk,p}$ [1)]			
	R60	$N_{Rk,p,fi}$	[kN]				
	R90	$N_{Rk,p,fi}$	[kN]				
	R120	$N_{Rk,p,fi}$	[kN]	$0{,}20 \cdot N_{Rk,p}$ [1)]			

[1)] $N_{Rk,p}$ is the characteristic resistance for pull-out failure $N_{Rk,p,cr}$ (see Table C1) in cracked concrete C20/25 under ambient temperature

Hilti metal expansion anchor HST2 V3	Annex C14
Performances Characteristic values of resistance under tension loading under fire exposure in cracked and uncracked concrete	

Table C11: Continued

				M8	M10	M12	M16
Concrete cone failure							
HST2-R V3							
Effective embedment depth		h_{ef}	[mm]	30 - 70	40 - 80	50 - 100	65 - 120
Characteristic resistance in concrete ≥ C20/25	R30	$N^0_{Rk,c,fi}$	[kN]	$h_{ef} / 200 \cdot N^0_{Rk,c} \leq N^0_{Rk,c}$			
	R60	$N^0_{Rk,c,fi}$	[kN]				
	R90	$N^0_{Rk,c,fi}$	[kN]				
	R120	$N^0_{Rk,c,fi}$	[kN]	$0{,}8 \cdot h_{ef} / 200 \cdot N^0_{Rk,c} \leq N^0_{Rk,c}$			
Spacing		$s_{cr,N}$	[mm]	4 h_{ef}			
		s_{min}	[mm]	40	55	60	70
Edge distance		$c_{cr,N}$	[mm]	2 h_{ef}			
		c_{min}	[mm]	Fire attack from one side: 2 h_{ef} Fire attack from more than one side: ≥ 300			

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

Table C12: Characteristic shear resistance under fire exposure for Hilti metal expansion anchor HST2 V3, HST2-F V3 and HST2 V3 BW in cracked and uncracked concrete

				M8	M10	M12	M16
Steel failure without lever arm							
HST2 V3, HST2-F V3 and HST2 V3 BW							
Effective embedment depth		$h_{ef,1}$	[mm]	30 - 44	40 - 59	50 - 69	65 - 84
Characteristic resistance	R30	$V_{Rk,s,fi}$	[kN]	0,4	0,9	1,7	3,1
	R60	$V_{Rk,s,fi}$	[kN]	0,3	0,8	1,3	2,4
	R90	$V_{Rk,s,fi}$	[kN]	0,3	0,6	1,1	2,0
	R120	$V_{Rk,s,fi}$	[kN]	0,2	0,5	0,8	1,6
Effective embedment depth		$h_{ef,2}$	[mm]	45 - 70	60 - 80	70 - 100	85 - 120
Characteristic resistance	R30	$V_{Rk,s,fi}$	[kN]	1,2	2,6	4,8	9,0
	R60	$V_{Rk,s,fi}$	[kN]	1,0	2,1	3,8	7,0
	R90	$V_{Rk,s,fi}$	[kN]	0,8	1,5	2,7	5,0
	R120	$V_{Rk,s,fi}$	[kN]	0,6	1,2	2,1	4,0
Steel failure with lever arm							
HST2 V3, HST2-F V3 and HST2 V3 BW							
Effective embedment depth		h_{ef}	[mm]	30 - 70	40 - 80	50 - 100	65 - 120
Characteristic resistance	R30	$M^0_{Rk,s,fi}$	[Nm]	1,3	3,4	7,5	19,1
	R60	$M^0_{Rk,s,fi}$	[Nm]	1,0	2,7	5,8	14,8
	R90	$M^0_{Rk,s,fi}$	[Nm]	0,8	2,0	4,2	10,6
	R120	$M^0_{Rk,s,fi}$	[Nm]	0,7	1,6	3,3	8,5
Concrete pryout failure							
HST2 V3, HST2-F V3 and HST2 V3 BW							
Effective embedment depth		h_{ef}	[mm]	30 - 70	40 - 80	50 - 100	65 - 120
Pryout factor		k_8	[-]	2,34	2,55	2,57	2,82
Characteristic resistance in concrete ≥ C20/25	R30	$V_{Rk,cp,fi}$	[kN]	$k_8 \cdot N_{Rk,c,fi(90)}$ [1]			
	R60	$V_{Rk,cp,fi}$	[kN]				
	R90	$V_{Rk,cp,fi}$	[kN]				
	R120	$V_{Rk,cp,fi}$	[kN]	$k_8 \cdot N_{Rk,c,fi(120)}$ [1]			

[1] $N_{Rk,c,fi(90)}$ and $N_{Rk,c,fi(120)}$ see Annex C13 with $N^0_{Rk,c,fi}$ under fire exposure for 90 or 120 minutes respectively

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

Hilti metal expansion anchor HST2 V3	Annex C16
Performances Characteristic values of resistance under shear loading under fire exposure in cracked and uncracked concrete	

Table C12: Continued

Concrete edge failure
HST2 V3, HST2-F V3, HST2 V3 BW
Concrete edge failure in concrete C20/25 to C50/60 under fire exposure $V^0_{Rk,c,fi} = 0{,}25 \times V^0_{Rk,c}$ (≤ R90) $V^0_{Rk,c,fi} = 0{,}20 \times V^0_{Rk,c}$ (R120) with $V^0_{Rk,c}$ = initial value of the characteristic resistance in cracked concrete C20/25 under normal temperature

Table C13: Characteristic shear resistance under fire exposure for Hilti metal expansion anchor HST2-R V3 in cracked and uncracked concrete

				M8	M10	M12	M16
Steel failure without lever arm							
HST2-R V3							
Effective embedment depth		$h_{ef,1}$	[mm]	30 - 44	40 - 59	50 - 69	65 - 84
Characteristic resistance	R30	$V_{Rk,s,fi}$	[kN]	0,4	0,9	1,7	3,1
	R60	$V_{Rk,s,fi}$	[kN]	0,3	0,8	1,3	2,4
	R90	$V_{Rk,s,fi}$	[kN]	0,3	0,6	1,1	2,0
	R120	$V_{Rk,s,fi}$	[kN]	0,2	0,5	0,8	1,6
Effective embedment depth		$h_{ef,2}$	[mm]	45 - 70	60 - 80	70 - 100	85 - 120
Characteristic resistance	R30	$V_{Rk,s,fi}$	[kN]	0,9	2,5	5,0	9,0
	R60	$V_{Rk,s,fi}$	[kN]	0,7	1,5	3,5	6,0
	R90	$V_{Rk,s,fi}$	[kN]	0,6	1,0	2,0	3,5
	R120	$V_{Rk,s,fi}$	[kN]	0,5	0,7	1,0	2,0
Steel failure with lever arm							
HST2-R V3							
Effective embedment depth		h_{ef}	[mm]	30 - 70	40 - 80	50 - 100	65 - 120
Characteristic resistance	R30	$M^0_{Rk,s,fi}$	[Nm]	1,0	3,3	8,1	20,6
	R60	$M^0_{Rk,s,fi}$	[Nm]	0,8	2,4	5,7	14,4
	R90	$M^0_{Rk,s,fi}$	[Nm]	0,7	1,6	3,2	8,2
	R120	$M^0_{Rk,s,fi}$	[Nm]	0,6	1,2	2,0	5,1

Table C13: Continued

				M8	M10	M12	M16
Concrete pryout failure							
HST2-R V3							
Effective embedment depth		h_{ef}	[mm]	30 - 70	40 - 80	50 - 100	65 - 120
Pryout factor		k_8	[-]	2,34	2,55	2,57	2,82
Characteristic resistance in concrete ≥ C20/25	R30	$V_{Rk,cp,fi}$	[kN]	$k_8 \cdot N_{Rk,c,fi(90)}$ 1)			
	R60	$V_{Rk,cp,fi}$	[kN]				
	R90	$V_{Rk,cp,fi}$	[kN]				
	R120	$V_{Rk,cp,fi}$	[kN]	$k_8 \cdot N_{Rk,c,fi(120)}$ 1)			
Concrete edge failure							
HST2-R V3							

Concrete edge failure in concrete C20/25 to C50/60 under fire exposure

$V^0_{Rk,c,fi} = 0{,}25 \text{ x } V^0_{Rk,c}$ (≤ R90)

$V^0_{Rk,c,fi} = 0{,}20 \text{ x } V^0_{Rk,c}$ (R120)

with $V^0_{Rk,c}$ = initial value of the characteristic resistance in cracked concrete C20/25 under normal temperature

1) $N_{Rk,c,fi(90)}$ and $N_{Rk,c,fi(120)}$ see Annex C15 with $N^0_{Rk,c,fi}$ under fire exposure for 90 or 120 minutes respectively

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