IT

DICHIARAZIONE DI PRESTAZIONE

N. HST_HST3_0432-CPR-00242-01

1. Codice di identificazione unico del prodotto-tipo:
Tassello a espansione in metallo Hilti HST, HST-R, HST-HCR, HST3 e HST3-R

2. Uso/i previsto/i:

Prodotto	Uso previsto
Tasselli metallici da utilizzare nel calcestruzzo	Per fissare e/o sostenere nel calcestruzzo degli elementi strutturali (che contribuiscono alla stabilità delle opere) o elementi molto pesanti.

3. Produttore:
Hilti Corporation, Business Unit Anchors, 9494 Schaan, Principato del Liechtenstein

4. Sistema/i di AVCP: Sistema 1

5. Documento per la valutazione europea: ETAG 001 Parte 2 (edizione del 04-2013) utilizzato come EAD
Valutazione tecnica europea: ETA-98/0001 (28.07.2016)
Organismo di valutazione tecnica: DIBt - Deutsches Institut für Bautechnik
Ente/i notificato/i: NB 0432 - MPA NRW

6. Prestazione/i dichiarata/e:

Stabilità e resistenza meccanica (BWR 1)

Caratteristiche essenziali	Prestazioni
Resistenza caratteristica per carichi statici e quasi statici, spostamenti	Vedere Allegato da C1 a C12
Resistenza caratteristica per la categoria di prestazioni antisismiche C1, spostamenti	Vedere Allegato da C13 a C16
Resistenza caratteristica per la categoria di prestazioni antisismiche C2, spostamenti	Vedere Allegato da C17 a C21

Sicurezza in caso d'incendio (BWR 2)

Caratteristiche essenziali	Prestazioni
Reazione al fuoco	Gli ancoraggi soddisfano i requisiti della Classe A1
Resistenza al fuoco	Vedere Allegato da C22 a C31

La prestazione del prodotto sopra identificato è conforme all'insieme delle prestazioni dichiarate. La presente dichiarazione di responsabilità viene emessa, in conformità al regolamento (UE) n. 305/2011, sotto la sola responsabilità del fabbricante sopra identificato.

Firmato a nome e per conto del fabbricante da:

Raimund Zaggl
Direttore Business Unit
Business Unit Anchor

Seppo Perämäki
Direttore Qualità
Business Unit Anchor

Hilti Corporation
Schaan, 27.03.2017

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	$\gamma_2 = \gamma_{inst}$	[-]	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	$\gamma_2 = \gamma_{inst}$	[-]	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	$\gamma_2 = \gamma_{inst}$	[-]	1,00				-	-

[1] Only HST and HST-R

[2] In absence of other national regulations

Hilti metal expansion anchor HST, HST-R, HST-HCR, HST3, HST3-R	**Annex C1**
Performances Characteristic values of resistance under tension loading in cracked and non-cracked concrete	

Deutsches Institut für Bautechnik DIBt

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

Deutsches Institut für Bautechnik DIBt

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

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

Deutsches Institut für Bautechnik DIBt

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

Deutsches Institut für Bautechnik DIBt

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

Deutsches Institut für Bautechnik DIBt

Table C3 continued

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

[1)] Only HST and HST-R

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

Deutsches Institut für Bautechnik DIBt

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

			M8	M10	M12	M16	M20	M24
Steel failure without lever arm								
HST3								
Effective embedment depth	$h_{ef,2}$	[mm]	47	60	70	85	101	125
Characteristic resistance	$V_{Rk,s}$	[kN]	13,8	23,6	35,4	55,3	83,9	94,0
Characteristic resistance using Seismic/Filling Set	$V_{Rk,s}$	[kN]	16,6	25,8	39,0	60,9	100,4	-
Partial safety factor	γ_{Ms} [1)]	[-]	1,25					1,50
Ductility factor	k_2	[-]	1,00					
HST3-R								
Effective embedment depth	$h_{ef,2}$	[mm]	47	60	70	85	101	125
Characteristic resistance	$V_{Rk,s}$	[kN]	15,7	25,3	36,7	63,6	97,2	115,0
Characteristic resistance using Seismic/Filling Set	$V_{Rk,s}$	[kN]	19,5	28,4	44,3	70,2	102,7	-
Partial safety factor	γ_{Ms} [1)]	[-]	1,25					1,30
Ductility factor	k_2	[-]	1,00					
HST3								
Effective embedment depth	$h_{ef,1}$	[mm]	-	40	50	65	-	-
Characteristic resistance	$V_{Rk,s}$	[kN]	-	21,9	34,0	54,5	-	-
Partial safety factor	γ_{Ms} [1)]	[-]	-	1,25			-	-
Ductility factor	k_2	[-]	-	1,00			-	-
HST3-R								
Effective embedment depth	$h_{ef,1}$	[mm]	-	40	50	65	-	-
Characteristic resistance	$V_{Rk,s}$	[kN]	-	25,6	31,1	48,6	-	-
Partial safety factor	γ_{Ms} [1)]	[-]	-	1,25			-	-
Ductility factor	k_2	[-]	-	1,00			-	-

[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

Deutsches Institut für Bautechnik DIBt

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	γ_{Ms} [1)]	[-]	1,25					1,50
HST3-R								
Characteristic resistance	$M^0_{Rk,s}$	[Nm]	27	53	93	216	425	730
Partial safety factor	γ_{Ms} [1)]	[-]	1,25					1,30
Concrete pryout failure								
HST3 and HST3-R								
Effective embedment depth	$h_{ef,2}$	[mm]	47	60	70	85	101	125
k-Factor	$k = k_3$	[-]	2,62	2,67	2,78	3,41	3,20	2,50
Partial safety factor	$\gamma_2 = \gamma_{inst}$	[-]	1,00					
HST3 and HST3-R								
Effective embedment depth	$h_{ef,1}$	[mm]	-	40	50	65	-	-
k-Factor	$k = k_3$	[-]	-	2,67	2,78	3,41	-	-
Partial safety factor	$\gamma_2 = \gamma_{inst}$	[-]	1,00					
Concrete edge failure								
HST3 and HST3-R								
Effective length of anchor in shear loading	$l_{f,2}$	[mm]	47	60	70	85	101	125
Effective length of anchor in shear loading with shallow embedmenth depth	$l_{f,1}$	[mm]	-	40	50	65	-	-
Diameter of anchor	d_{nom}	[mm]	8	10	12	16	20	24
Partial safety factor	$\gamma_2 = \gamma_{inst}$	[-]	1,00					

[1)] In absence of other national regulations

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

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

Annex C8

Deutsches Institut für Bautechnik DIBt

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

Deutsches Institut für Bautechnik DIBt

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

Deutsches Institut für Bautechnik DIBt

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

Deutsches Institut für Bautechnik DIBt

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

Deutsches Institut für Bautechnik DIBt

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

Deutsches Institut für Bautechnik DIBt

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

Deutsches Institut für Bautechnik DIBt

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

Deutsches Institut für Bautechnik DIBt

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

Deutsches Institut für Bautechnik DIBt

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

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

[1)] In absence of other national regulations

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

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

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

Hilti metal expansion anchor HST, HST-R, HST-HCR, HST3, HST3-R	**Annex C17**
Performances Characteristic tension resistance and displacements under tension loads for seismic loading and performance category C2 according TR 045	

Deutsches Institut für Bautechnik DIBt

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

Deutsches Institut für Bautechnik DIBt

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

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

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

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

[1)] In absence of other national regulations

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

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

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

Hilti metal expansion anchor HST, HST-R, HST-HCR, HST3, HST3-R	**Annex C19**
Performances Characteristic shear resistance and displacements under shear loads for seismic loading and performance category C2 according TR 045	

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

Deutsches Institut für Bautechnik DIBt

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	-

Deutsches Institut für Bautechnik DIBt

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

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

[1)] Only HST and HST-R

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

Hilti metal expansion anchor HST, HST-R, HST-HCR, HST3, HST3-R	**Annex C22**
Performances Characteristic values of resistance under tension loading under fire exposure in cracked and non-cracked concrete	

Deutsches Institut für Bautechnik DIBt

Table C19 continued

				M8	M10	M12	M16	M20 [1)]	M24 [1)]
Concrete cone failure									
HST, HST-R and HST-HCR									
Characteristic resistance in concrete ≥ C20/25	R30	$N^0_{Rk,c,fi}$	[kN]	2,7	5,0	7,4	11,0	18,5	31,4
	R60	$N^0_{Rk,c,fi}$	[kN]						
	R90	$N^0_{Rk,c,fi}$	[kN]						
	R120	$N^0_{Rk,c,fi}$	[kN]	2,2	4,0	5,9	8,8	14,8	25,2
Spacing		$s_{cr,N}$	[mm]	4 h_{ef}					
		s_{min}	[mm]	40	55	60	70	100	125
Edge distance		$c_{cr,N}$	[mm]	2 h_{ef}					
		c_{min}	[mm]	Fire attack from one side: 2 h_{ef} Fire attack from more than one side: ≥ 300					

[1)] Only HST and HST-R

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

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

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

Annex C23

Deutsches Institut für Bautechnik DIBt

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

Deutsches Institut für Bautechnik DIBt

Table C20 continued

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

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

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

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

Annex C25

Deutsches Institut für Bautechnik DIBt

Table C20 continued

				M8	M10	M12	M16	M20	M24
Concrete cone failure									
HST3 and HST3-R									
Effective embedment depth		$h_{ef,2}$	[mm]	47	60	70	85	101	125
Characteristic resistance in concrete ≥ C20/25	R30	$N^0_{Rk,c,fi}$	[kN]	2,7	5,0	7,4	12,0	18,5	31,4
	R60	$N^0_{Rk,c,fi}$	[kN]						
	R90	$N^0_{Rk,c,fi}$	[kN]						
	R120	$N^0_{Rk,c,fi}$	[kN]	2,2	4,0	5,9	9,6	14,8	25,2
Spacing		$s_{cr,N}$	[mm]	$4\ h_{ef}$					
		s_{min}	[mm]	35	40	50	65	90	125
Edge distance		$c_{cr,N}$	[mm]	$2\ h_{ef}$					
		c_{min}	[mm]	Fire attack from one side: $2\ h_{ef}$ Fire attack from more than one side: ≥ 300					
HST3 and HST3-R									
Effective embedment depth		$h_{ef,1}$	[mm]	-	40	50	65	-	-
Characteristic resistance in concrete ≥ C20/25	R30	$N^0_{Rk,c,fi}$	[kN]	-	1,8	3,2	6,1	-	-
	R60	$N^0_{Rk,c,fi}$	[kN]						
	R90	$N^0_{Rk,c,fi}$	[kN]						
	R120	$N^0_{Rk,c,fi}$	[kN]	-	1,5	2,5	4,9	-	-
Spacing		$s_{cr,N}$	[mm]	-	$4\ h_{ef}$			-	-
		s_{min}	[mm]	-	40	50	65	-	-
Edge distance		$c_{cr,N}$	[mm]	-	$2\ h_{ef}$			-	-
		c_{min}	[mm]	Fire attack from one side: $2\ h_{ef}$ Fire attack from more than one side: ≥ 300					

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

Deutsches Institut für Bautechnik DIBt

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

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

[1)] Only HST and HST-R

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

Hilti metal expansion anchor HST, HST-R, HST-HCR, HST3, HST3-R	**Annex C27**
Performances Characteristic values of resistance under shear loading under fire exposure in cracked and non-cracked concrete	

Deutsches Institut für Bautechnik DIBt

Table C21 continued

				M8	M10	M12	M16	M20 [1)]	M24 [1)]
Concrete pryout failure									
HST, HST-R and HST-HCR									
k-Factor		$k = k_3$	[-]	2,00	2,00	2,20	2,50	2,50	2,50
Characteristic resistance in concrete ≥ C20/25	R30	$V^0_{Rk,cp,fi}$	[kN]	5,4	10,0	16,0	27,2	49,4	84,5
	R60	$V^0_{Rk,cp,fi}$	[kN]						
	R90	$V^0_{Rk,cp,fi}$	[kN]						
	R120	$V^0_{Rk,cp,fi}$	[kN]	4,4	8,0	12,9	21,7	39,6	67,5
Concrete edge failure									
HST, HST-R and HST-HCR									
The initial value $V^0_{Rk,c,fi}$ of the characteristic resistance in concrete C20/25 to C50/60 under fire exposure may be determined by: $V^0_{Rk,c,fi} = 0,25 \times V^0_{Rk,c}$ (≤ R90) $V^0_{Rk,c,fi} = 0,20 \times V^0_{Rk,c}$ (R120) with $V^0_{Rk,c}$ initial value of the characteristic resistance in cracked concrete C20/25 under normal temperature.									

[1)] Only HST and HST-R

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

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

Deutsches Institut für Bautechnik DIBt

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.

Deutsches Institut für Bautechnik DIBt

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

Deutsches Institut für Bautechnik DIBt

Table C22 continued

				M8	M10	M12	M16	M20	M24
Concrete pryout failure									
HST3 and HST3-R									
Effective embedment depth		$h_{ef,2}$	[mm]	47	60	70	85	101	125
k-Factor		$k = k_3$	[-]	2,62	2,67	2,78	3,41	3,20	2,50
Characteristic resistance in concrete ≥ C20/25	R30	$V^0_{Rk,cp,fi}$	[kN]	7,0	13,0	20,7	40,8	37,0	62,8
	R60	$V^0_{Rk,cp,fi}$	[kN]						
	R90	$V^0_{Rk,cp,fi}$	[kN]						
	R120	$V^0_{Rk,cp,fi}$	[kN]	5,7	10,4	16,5	32,6	29,6	50,4
HST3 and HST3-R									
Effective embedment depth		$h_{ef,1}$	[mm]	-	40	50	65	-	-
k-Factor		$k = k_3$	[-]	-	2,67	2,78	3,41	-	-
Characteristic resistance in concrete ≥ C20/25	R30	$V^0_{Rk,cp,fi}$	[kN]	-	4,7	8,9	20,8	-	-
	R60	$V^0_{Rk,cp,fi}$	[kN]						
	R90	$V^0_{Rk,cp,fi}$	[kN]						
	R120	$V^0_{Rk,cp,fi}$	[kN]	-	3,8	7,1	16,7	-	-
Concrete edge failure									
HST3 and HST3-R									
The initial value $V^0_{Rk,c,fi}$ of the characteristic resistance in concrete C20/25 to C50/60 under fire exposure may be determined by: $V^0_{Rk,c,fi} = 0,25 \times V^0_{Rk,c}$ (≤ R90) $V^0_{Rk,c,fi} = 0,20 \times V^0_{Rk,c}$ (R120) with $V^0_{Rk,c}$ initial value of the characteristic resistance in cracked concrete C20/25 under normal temperature.									

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

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