HILTI TECHNICAL DATA

Date	18.01.2021
From	Corinna Müller, ARAmc
For information	BU Anchor Technical Marketing

Hilti HIT-RE 500 V4
Technical data for service life of 100 years
assessment based on ETA-20/0541

1 Scope

There data are intended for BU Anchor Technical Marketing to be applicable for a service life of 100 years and shall be released for PROFIS as Hilti Technical Data, only.

These data are not covered by ETA-20/0541 (issued 21.11.2020).

For further information see: Report ARA 20-003.

Application is restricted to static and quasi-static loading and seismic performance category C1.

Released by:

Corinna Müller
Technical Data and Approvals
18.01.2020

Michael Roessle
Group Manager Technical Data and Approvals
20.01.2020

2 Intended use and restrictions

In Table 1 the application scope and limits are given.

Table 1: Application scope

Anchorages subject to	Static and quasi static loading Seismic performance category C1
Base material	Concrete strength C20/25 to C50/60 Compacted reinforced or unreinforced normal weight concrete without fibres according to EN 206:2013+A1:2016 Uncracked and cracked concrete
Concrete condition	acc. ETA-20/0541 (issued 21.11.2020)
Embedment depth	acc. ETA-20/0541 (issued 21.11.2020)
Installation direction	acc. ETA-20/0541 (issued 21.11.2020)
Temperature in base material at installation	acc. ETA-20/0541 (issued 21.11.2020)
Temperature in base material in-service	acc. ETA-20/0541 (issued 21.11.2020)
Drilling technique	Hammer drilling Hammer drilling with Hilti hollow drill bit TE-CD, TE-YD Diamond coring Diamond coring with roughening with Hilti Roughening tool TE-YRT
Cleaning	acc. ETA-20/0541 (issued 21.11.2020) / MPII
Setting	acc. ETA-20/0541 (issued 21.11.2020) / MPII

3 Installation parameters

The installation parameters are given in Table 2.

Table 2: Installation parameters

Installation parameter	acc. ETA-20/0541 (issued 21.11.2020)
Minimum thickness of concrete member h_{min}	
Minimum spacing s_{min}	
Minimum edge distance c_{min}	

4 Essential characteristics

In Table 3 the essential characteristics are summarized.

Table 3: Essential characteristics

TENSION LOAD	
Steel failure	acc. ETA-20/0541 (issued 21.11.2020)
Combined pull-out and concrete cone failure	see Table 4 to Table 9 (static and quasi-static loading) see Table 14 to Table 19 (seismic category C1)
Concrete cone failure	acc. ETA-20/0541 (issued 21.11.2020)
Splitting failure	acc. ETA-20/0541 (issued 21.11.2020)
Displacements	see Table 10 to Table 13 (static and quasi-static loading)
SHEAR LOAD	
Steel failure	acc. ETA-20/0541 (issued 21.11.2020)
Pry-out and concrete edge failure	acc. ETA-20/0541 (issued 21.11.2020)
Displacements	acc. ETA-20/0541 (issued 21.11.2020)

Table 4: Essential characteristics for threaded rods under tension load in concrete for a service life of 100 years

Threaded rod, HAS-U-…, HIT-V-…, AM…8.8				**M8**	**M10**	**M12**	**M16**	**M20**	**M24**	**M27**	**M30**
Combined pullout and concrete cone failure for service life of 100 years											
Characteristic resistance in uncracked concrete C20/25 in **hammer drilled holes** and **hammer drilled holes with Hilti hollow drill bit TE-CD or TE-YD** and **diamond cored holes with roughening with Hilti Roughening tool TE-YRT**											
Temperature range I:	40°C / 24°C	$\tau_{Rk,ucr}$	[N/mm²]	19	18	18	17	16	15	15	14
Temperature range II:	55°C / 43°C	$\tau_{Rk,ucr}$	[N/mm²]	15	14	14	13	12	12	11	11
Temperature range III:	75°C / 55°C	$\tau_{Rk,ucr}$	[N/mm²]	5,0	5,0	5,0	4,5	4,0	4,0	3,5	3,5
Characteristic resistance in uncracked concrete C20/25 in **diamond cored holes**											
Temperature range I:	40°C / 24°C	$\tau_{Rk,ucr}$	[N/mm²]	13	13	13	13	12	12	12	12
Temperature range II:	55°C / 43°C	$\tau_{Rk,ucr}$	[N/mm²]	10	10	10	10	10	10	10	9,0
Temperature range III:	75°C / 55°C	$\tau_{Rk,ucr}$	[N/mm²]	4,5	4,5	4,5	4,5	4,5	4,5	4,5	4,0
Characteristic resistance in uncracked concrete C20/25 in **hammer drilled holes and installation in water-filled drill holes**											
Temperature range I:	40°C / 24°C	$\tau_{Rk,ucr}$	[N/mm²]	16	16	15	15	14	13	12	12
Temperature range II:	55°C / 43°C	$\tau_{Rk,ucr}$	[N/mm²]	12	12	12	11	10	10	9,0	9,0
Temperature range III:	75°C / 55°C	$\tau_{Rk,ucr}$	[N/mm²]	4,0	4,0	4,0	3,5	3,5	3,0	3,0	3,0
Characteristic resistance in cracked concrete C20/25 in **hammer drilled holes** and **hammer drilled holes with Hilti hollow drill bit TE-CD or TE-YD** and **diamond cored holes with roughening with Hilti Roughening tool TE-YRT**											
Temperature range I:	40°C / 24°C	$\tau_{Rk,cr}$	[N/mm²]	5,5	6,5	7,0	6,5	6,5	6,0	5,5	5,5
Temperature range II:	55°C / 43°C	$\tau_{Rk,cr}$	[N/mm²]	4,0	5,0	5,0	5,0	4,5	4,5	4,0	3,5
Temperature range III:	75°C / 55°C	$\tau_{Rk,cr}$	[N/mm²]	2,0	2,5	2,5	2,5	2,0	2,0	2,0	2,0
Influence factors ψ on bond resistance τ_{Rk}											
Influence of concrete strength											
Cracked and uncracked concrete	in hammer drilled holes and hammer drilled holes with Hilti hollow drill bit TE-CD or TE-YD and diamond cored holes	ψ_c	C30/37	1,04							
			C40/50	1,07							
			C50/60	1,09							
	in diamond cored holes with roughening with Hilti Roughening tool TE-YRT	ψ_c	C30/37	[1]			1,0				
			C40/50								
			C50/60								

[1] No performance assessed.

Table 5: Essential characteristics for threaded rods under tension load in concrete for a service life of 100 years

Threaded rod, HAS-…, HIT-V-…, size				**[in.]**	**3/8**	**1/2**	**5/8**	**3/4**	**7/8**	**1**	**1 1/4**
Combined pullout and concrete cone failure for service life of 100 years											
Characteristic resistance in uncracked concrete C20/25 in **hammer drilled holes** and **hammer drilled holes with Hilti hollow drill bit TE-CD or TE-YD** and **diamond cored holes with roughening with Hilti Roughening tool TE-YRT**											
Temperature range I:	40°C / 24°C	$\tau_{Rk,ucr}$	[N/mm²]		19	18	17	16	16	15	14
Temperature range II:	55°C / 43°C	$\tau_{Rk,ucr}$	[N/mm²]		13	13	13	13	12	11	10
Temperature range III:	75°C / 55°C	$\tau_{Rk,ucr}$	[N/mm²]		4,5	4,5	4,5	4,5	4,0	4,0	3,5
Characteristic resistance in uncracked concrete C20/25 in **diamond cored holes**											
Temperature range I:	40°C / 24°C	$\tau_{Rk,ucr}$	[N/mm²]		13	13	13	12	12	12	12
Temperature range II:	55°C / 43°C	$\tau_{Rk,ucr}$	[N/mm²]		10	10	10	10	10	10	9,0
Temperature range III:	75°C / 55°C	$\tau_{Rk,ucr}$	[N/mm²]		4,5	4,5	4,5	4,5	4,5	4,5	4,0
Characteristic resistance in uncracked concrete C20/25 in **hammer drilled holes and installation in water-filled drill holes**											
Temperature range I:	40°C / 24°C	$\tau_{Rk,ucr}$	[N/mm²]		16	15	15	14	13	13	12
Temperature range II:	55°C / 43°C	$\tau_{Rk,ucr}$	[N/mm²]		12	12	11	11	10	10	8,5
Temperature range III:	75°C / 55°C	$\tau_{Rk,ucr}$	[N/mm²]		4,0	4,0	3,5	3,5	3,5	3,0	2,5
Characteristic resistance in cracked concrete C20/25 in **hammer drilled holes** and **hammer drilled holes with Hilti hollow drill bit TE-CD or TE-YD** and **diamond cored holes with roughening with Hilti Roughening tool TE-YRT**											
Temperature range I:	40°C / 24°C	$\tau_{Rk,cr}$	[N/mm²]		5,5	6,5	6,5	6,5	6,0	6,0	5,5
Temperature range II:	55°C / 43°C	$\tau_{Rk,cr}$	[N/mm²]		4,0	4,0	4,5	4,5	4,5	4,0	3,5
Temperature range III:	75°C / 55°C	$\tau_{Rk,cr}$	[N/mm²]		2,0	2,5	2,5	2,0	2,0	2,0	1,5
Influence factors ψ on bond resistance τ_{Rk}											
Influence of concrete strength											
Cracked and uncracked concrete	in hammer drilled holes and hammer drilled holes with Hilti hollow drill bit TE-CD or TE-YD and diamond cored holes	ψ_c		C30/37	1,04						
				C40/50	1,07						
				C50/60	1,09						
	in diamond cored holes with roughening with Hilti Roughening tool TE-YRT	ψ_c		C30/37	[1]		1,0				
				C40/50							
				C50/60							

[1] No performance assessed.

Table 6: Essential characteristics for internally threaded sleeve HIS-(R)N under tension load in concrete for a service life of 100 years

HIS-(R)N				**M8**	**M10**	**M12**	**M16**	**M20**
Outer diameter of sleeve		d_{nom}	[mm]	12,5	16,5	20,5	25,4	27,6
Combined pullout and concrete cone failure for service life of 100 years								
Characteristic resistance in uncracked concrete C20/25 in **hammer drilled holes** and **hammer drilled holes with Hilti hollow drill bit TE-CD or TE-YD** and **diamond cored holes with roughening with Hilti Roughening tool TE-YRT**								
Temperature range I:	40°C / 24°C	$\tau_{Rk,ucr}$	[N/mm²]	14	14	14	14	14
Temperature range II:	55°C / 43°C	$\tau_{Rk,ucr}$	[N/mm²]	11	11	11	11	11
Temperature range III:	75°C / 55°C	$\tau_{Rk,ucr}$	[N/mm²]	3,5	3,5	3,5	3,5	3,5
Characteristic resistance in uncracked concrete C20/25 in **diamond cored holes**								
Temperature range I:	40°C / 24°C	$\tau_{Rk,ucr}$	[N/mm²]	8,5	9,0	9,5	9,5	10
Temperature range II:	55°C / 43°C	$\tau_{Rk,ucr}$	[N/mm²]	6,0	6,5	6,5	6,5	6,5
Temperature range III:	75°C / 55°C	$\tau_{Rk,ucr}$	[N/mm²]	3,0	3,5	3,5	3,5	3,5
Characteristic resistance in uncracked concrete C20/25 in **hammer drilled holes and installation in water-filled drill holes**								
Temperature range I:	40°C / 24°C	$\tau_{Rk,ucr}$	[N/mm²]	12	12	12	12	12
Temperature range II:	55°C / 43°C	$\tau_{Rk,ucr}$	[N/mm²]	9,0	9,0	9,0	9,0	9,0
Temperature range III:	75°C / 55°C	$\tau_{Rk,ucr}$	[N/mm²]	3,0	3,0	3,0	3,0	3,0
Characteristic resistance in cracked concrete C20/25 in **hammer drilled holes** and **hammer drilled holes with Hilti hollow drill bit TE-CD or TE-YD** and **diamond cored holes with roughening with Hilti Roughening tool TE-YRT**								
Temperature range I:	40°C / 24°C	$\tau_{Rk,cr}$	[N/mm²]	5,5	5,5	5,5	6,0	6,0
Temperature range II:	55°C / 43°C	$\tau_{Rk,cr}$	[N/mm²]	4,5	4,5	4,5	4,5	4,5
Temperature range III:	75°C / 55°C	$\tau_{Rk,cr}$	[N/mm²]	2,5	2,5	2,5	2,5	2,5
Influence factors ψ on bond resistance τ_{Rk}								
Influence of concrete strength								
Cracked and uncracked concrete	in hammer drilled holes and hammer drilled holes with Hilti hollow drill bit TE-CD or TE-YD and diamond cored holes	ψ_c	C30/37	1,04				
			C40/50	1,07				
			C50/60	1,09				
	in diamond cored holes with roughening with Hilti Roughening tool TE-YRT	ψ_c	C30/37	[1]	1,0			
			C40/50					
			C50/60					

[1] No performance assessed.

Table 7: Essential characteristics for internally threaded sleeve HIS-(R)N under tension load in concrete for a service life of 100 years

HIS-(R)N, size				**[in.]**	**3/8**	**1/2**	**5/8**	**3/4**
Outer diameter of sleeve			d_{nom}	[mm]	16,5	20,5	25,4	27,6
Combined pullout and concrete cone failure for service life of 100 years								
Characteristic resistance in uncracked concrete C20/25 in **hammer drilled holes** and **hammer drilled holes with Hilti hollow drill bit TE-CD or TE-YD** and **diamond cored holes with roughening with Hilti Roughening tool TE-YRT**								
Temperature range I:	40°C / 24°C		$\tau_{Rk,ucr}$	[N/mm²]	14	14	14	14
Temperature range II:	55°C / 43°C		$\tau_{Rk,ucr}$	[N/mm²]	11	11	11	11
Temperature range III:	75°C / 55°C		$\tau_{Rk,ucr}$	[N/mm²]	3,5	3,5	3,5	3,5
Characteristic resistance in uncracked concrete C20/25 in **diamond cored holes**								
Temperature range I:	40°C / 24°C		$\tau_{Rk,ucr}$	[N/mm²]	9,0	9,5	9,5	10
Temperature range II:	55°C / 43°C		$\tau_{Rk,ucr}$	[N/mm²]	6,5	6,5	6,5	6,5
Temperature range III:	75°C / 55°C		$\tau_{Rk,ucr}$	[N/mm²]	3,5	3,5	3,5	3,5
Characteristic resistance in uncracked concrete C20/25 in **hammer drilled holes and installation in water-filled drill holes**								
Temperature range I:	40°C / 24°C		$\tau_{Rk,ucr}$	[N/mm²]	12	12	12	12
Temperature range II:	55°C / 43°C		$\tau_{Rk,ucr}$	[N/mm²]	9,0	9,0	9,0	9,0
Temperature range III:	75°C / 55°C		$\tau_{Rk,ucr}$	[N/mm²]	3,0	3,0	3,0	3,0
Characteristic resistance in cracked concrete C20/25 in **hammer drilled holes** and **hammer drilled holes with Hilti hollow drill bit TE-CD or TE-YD** and **diamond cored holes with roughening with Hilti Roughening tool TE-YRT**								
Temperature range I:	40°C / 24°C		$\tau_{Rk,cr}$	[N/mm²]	5,5	5,5	6,0	6,0
Temperature range II:	55°C / 43°C		$\tau_{Rk,cr}$	[N/mm²]	4,5	4,5	4,5	4,5
Temperature range III:	75°C / 55°C		$\tau_{Rk,cr}$	[N/mm²]	2,5	2,5	2,5	2,5
Influence factors ψ on bond resistance τ_{Rk}								
Influence of concrete strength								
Cracked and uncracked concrete	in hammer drilled holes and hammer drilled holes with Hilti hollow drill bit TE-CD or TE-YD and diamond cored holes		ψ_c	C30/37	1,04			
				C40/50	1,07			
				C50/60	1,09			
	in diamond cored holes with roughening with Hilti Roughening tool TE-YRT		ψ_c	C30/37	[1]	1,0	[1]	
				C40/50				
				C50/60				

[1] No performance assessed.

Table 8: Essential characteristics for Hilti tension anchor HZA / HZA-R under tension load in concrete for a service life of 100 years

HZA / HZA-R				**M12**	**M16**	**M20**	**M24**	**M27**
Rebar diameter		ϕ	[mm]	12	16	20	25	28
Combined pullout and concrete cone failure for service life of 100 years								
Characteristic resistance in uncracked concrete C20/25 in **hammer drilled holes** and **hammer drilled holes with Hilti hollow drill bit TE-CD or TE-YD** and **diamond cored holes with roughening with Hilti Roughening tool TE-YRT**								
Temperature range I:	40°C / 24°C	$\tau_{Rk,ucr}$	[N/mm²]	15	15	14	14	14
Temperature range II:	55°C / 43°C	$\tau_{Rk,ucr}$	[N/mm²]	11	11	11	10	10
Temperature range III:	75°C / 55°C	$\tau_{Rk,ucr}$	[N/mm²]	4,0	3,5	3,5	3,5	3,5
Characteristic resistance in uncracked concrete C20/25 in **diamond cored holes**								
Temperature range I:	40°C / 24°C	$\tau_{Rk,ucr}$	[N/mm²]	9,5	9,5	9,5	9,5	10
Temperature range II:	55°C / 43°C	$\tau_{Rk,ucr}$	[N/mm²]	6,5	6,5	6,5	6,5	6,5
Temperature range III:	75°C / 55°C	$\tau_{Rk,ucr}$	[N/mm²]	3,5	3,5	3,5	3,5	3,5
Characteristic resistance in uncracked concrete C20/25 in **hammer drilled holes and installation in water-filled drill holes**								
Temperature range I:	40°C / 24°C	$\tau_{Rk,ucr}$	[N/mm²]	12	12	12	12	12
Temperature range II:	55°C / 43°C	$\tau_{Rk,ucr}$	[N/mm²]	9,0	9,0	9,0	9,0	8,5
Temperature range III:	75°C / 55°C	$\tau_{Rk,ucr}$	[N/mm²]	3,0	3,0	3,0	3,0	2,5
Characteristic resistance in cracked concrete C20/25 in **hammer drilled holes** and **hammer drilled holes with Hilti hollow drill bit TE-CD or TE-YD** and **diamond cored holes with roughening with Hilti Roughening tool TE-YRT**								
Temperature range I:	40°C / 24°C	$\tau_{Rk,cr}$	[N/mm²]	8,0	8,0	7,5	7,5	7,5
Temperature range II:	55°C / 43°C	$\tau_{Rk,cr}$	[N/mm²]	6,0	6,0	5,5	5,5	5,5
Temperature range III:	75°C / 55°C	$\tau_{Rk,cr}$	[N/mm²]	3,0	3,5	3,5	3,5	3,5
Influence factors ψ on bond resistance τ_{Rk}								
Influence of concrete strength								
Cracked and uncracked concrete	in hammer drilled holes and hammer drilled holes with Hilti hollow drill bit TE-CD or TE-YD and diamond cored holes	ψ_c	C30/37	1,04				
			C40/50	1,07				
			C50/60	1,09				
	in diamond cored holes with roughening with Hilti Roughening tool TE-YRT	ψ_c	C30/37	[1]	1,0			
			C40/50					
			C50/60					

[1] No performance assessed.

Table 9: Essential characteristics for reinforcing bars (rebars) under tension load in concrete for a service life of 100 years

Reinforcing bar (rebar)					**ϕ 8**	**ϕ 10**	**ϕ 12**	**ϕ 14**	**ϕ 16**	**ϕ 20**	**ϕ 25**	**ϕ 28**	**ϕ 30**	**ϕ 32**
Combined pullout and concrete cone failure for service life of 100 years														
Characteristic resistance in uncracked concrete C20/25 in **hammer drilled holes** and **hammer drilled holes with Hilti hollow drill bit TE-CD or TE-YD** and **diamond cored holes with roughening with Hilti Roughening tool TE-YRT**														
Temperature range I:	40°C / 24°C	$\tau_{Rk,ucr}$	[N/mm²]		10	15	15	15	15	14	14	14	13	13
Temperature range II:	55°C / 43°C	$\tau_{Rk,ucr}$	[N/mm²]		7,5	11	11	11	11	11	10	10	10	10
Temperature range III:	75°C / 55°C	$\tau_{Rk,ucr}$	[N/mm²]		2,5	4,0	4,0	4,0	3,5	3,5	3,5	3,5	3,5	3,5
Characteristic resistance in uncracked concrete C20/25 in **diamond cored holes**														
Temperature range I:	40°C / 24°C	$\tau_{Rk,ucr}$	[N/mm²]		9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,5	9,5	9,5
Temperature range II:	55°C / 43°C	$\tau_{Rk,ucr}$	[N/mm²]		6,5	6,5	6,5	6,5	6,5	6,5	6,5	6,5	6,5	6,5
Temperature range III:	75°C / 55°C	$\tau_{Rk,ucr}$	[N/mm²]		2,0	3,5	3,5	3,5	4,0	4,0	4,0	4,0	4,0	4,0
Characteristic resistance in uncracked concrete C20/25 in **hammer drilled holes and installation in water-filled drill holes**														
Temperature range I:	40°C / 24°C	$\tau_{Rk,ucr}$	[N/mm²]		8,0	12	12	12	12	12	11	11	11	11
Temperature range II:	55°C / 43°C	$\tau_{Rk,ucr}$	[N/mm²]		6,0	9,5	9,5	9,5	9,0	9,0	9,0	8,5	8,5	8,5
Temperature range III:	75°C / 55°C	$\tau_{Rk,ucr}$	[N/mm²]		2,0	3,0	3,0	3,0	3,0	3,0	3,0	2,5	2,5	2,5
Characteristic resistance in cracked concrete C20/25 in **hammer drilled holes** and **hammer drilled holes with Hilti hollow drill bit TE-CD or TE-YD** and **diamond cored holes with roughening with Hilti Roughening tool TE-YRT**														
Temperature range I:	40°C / 24°C	$\tau_{Rk,cr}$	[N/mm²]		2,5	7,5	8,0	8,0	8,0	7,5	7,5	7,5	7,0	7,0
Temperature range II:	55°C / 43°C	$\tau_{Rk,cr}$	[N/mm²]		2,0	5,5	6,0	6,0	5,5	5,5	5,5	5,5	5,0	5,0
Temperature range III:	75°C / 55°C	$\tau_{Rk,cr}$	[N/mm²]		1,0	3,0	3,0	3,0	3,0	3,0	3,0	3,0	2,5	5,5
Influence factors ψ on bond resistance τ_{Rk}														
Influence of concrete strength														
Cracked and uncracked concrete	in hammer drilled holes and hammer drilled holes with Hilti hollow drill bit TE-CD or TE-YD and diamond cored holes	ψ_c	C30/37		1,04									
			C40/50		1,07									
			C50/60		1,09									
	in diamond cored holes with roughening with Hilti Roughening tool TE-YRT	ψ_c	C30/37		[1]			1,0					[1]	
			C40/50											
			C50/60											

[1] No performance assessed.

Table 10: Displacements for threaded rods under tension load in concrete for a service life of 100 years

Threaded rod, HAS-U-…, HIT-V-…, AM…8.8			**M8**	**M10**	**M12**	**M16**	**M20**	**M24**	**M27**	**M30**
Threaded rod, HAS-…, HIT-V-…, size			**-**	**3/8**	**1/2**	**5/8**	**3/4**	**7/8**	**1**	**1 1/4**
Displacement in uncracked concrete										
Temperature range I:	40°C / 24°C	δ_{N0} [mm/(N/mm²)]	0,04	0,05	0,05	0,06	0,06	0,07	0,08	0,08
		$\delta_{N\infty}$ [mm/(N/mm²)]	0,12	0,13	0,14	0,16	0,18	0,20	0,22	0,23
Temperature range II:	55°C / 43°C	δ_{N0} [mm/(N/mm²)]	0,05	0,05	0,06	0,07	0,07	0,08	0,09	0,10
		$\delta_{N\infty}$ [mm/(N/mm²)]	0,12	0,13	0,14	0,16	0,19	0,21	0,22	0,24
Temperature range III:	75°C / 55°C	δ_{N0} [mm/(N/mm²)]	0,05	0,06	0,06	0,07	0,08	0,09	0,09	0,10
		$\delta_{N\infty}$ [mm/(N/mm²)]	0,13	0,14	0,16	0,18	0,20	0,22	0,24	0,26
Displacement in cracked concrete										
Temperature range I:	40°C / 24°C	δ_{N0} [mm/(N/mm²)]	0,02	0,03	0,05	0,08	0,10	0,13	0,15	0,18
		$\delta_{N\infty}$ [mm/(N/mm²)]	0,13	0,20	0,16	0,22	0,19	0,21	0,22	0,24
Temperature range II:	55°C / 43°C	δ_{N0} [mm/(N/mm²)]	0,02	0,04	0,06	0,09	0,12	0,16	0,18	0,21
		$\delta_{N\infty}$ [mm/(N/mm²)]	0,15	0,24	0,19	0,26	0,23	0,24	0,24	0,28
Temperature range III:	75°C / 55°C	δ_{N0} [mm/(N/mm²)]	0,02	0,04	0,06	0,10	0,13	0,17	0,19	0,22
		$\delta_{N\infty}$ [mm/(N/mm²)]	0,17	0,26	0,21	0,28	0,25	0,26	0,26	0,30

Table 11: Displacements for internally threaded HIS-(R)N under tension load in concrete for a service life of 100 years

HIS-(R)N			**M8**	**M10**	**M12**	**M16**	**M20**
HIS-(R)N, size		**[in.]**	**-**	**3/8**	**1/2**	**5/8**	**3/4**
Displacement in uncracked concrete							
Temperature range I:	40°C / 24°C	δ_{N0} [mm/(N/mm²)]	0,05	0,06	0,06	0,07	0,08
		$\delta_{N\infty}$ [mm/(N/mm²)]	0,14	0,15	0,18	0,20	0,21
Temperature range II:	55°C / 43°C	δ_{N0} [mm/(N/mm²)]	0,06	0,07	0,07	0,08	0,09
		$\delta_{N\infty}$ [mm/(N/mm²)]	0,15	0,17	0,19	0,21	0,22
Temperature range III:	75°C / 55°C	δ_{N0} [mm/(N/mm²)]	0,06	0,07	0,07	0,09	0,10
		$\delta_{N\infty}$ [mm/(N/mm²)]	0,17	0,19	0,21	0,23	0,24
Displacement in cracked concrete							
Temperature range I:	40°C / 24°C	δ_{N0} [mm/(N/mm²)]	0,02	0,03	0,05	0,08	0,10
		$\delta_{N\infty}$ [mm/(N/mm²)]	0,15	0,22	0,19	0,20	0,20
Temperature range II:	55°C / 43°C	δ_{N0} [mm/(N/mm²)]	0,02	0,04	0,06	0,09	0,12
		$\delta_{N\infty}$ [mm/(N/mm²)]	0,19	0,27	0,23	0,24	0,24
Temperature range III:	75°C / 55°C	δ_{N0} [mm/(N/mm²)]	0,02	0,04	0,06	0,10	0,13
		$\delta_{N\infty}$ [mm/(N/mm²)]	0,21	0,30	0,26	0,27	0,27

Table 12: Displacements for Hilti tension anchor HZA / HZA-R under tension load in concrete for a service life of 100 years

HZA / HZA-R				M12	M16	M20	M24	M27
Rebar diameter		ϕ	[mm]	12	16	20	25	28
Displacement in uncracked concrete								
Temperature range I:	40°C / 24°C	δ_{N0}	[mm/(N/mm²)]	0,05	0,06	0,07	0,07	0,08
		$\delta_{N\infty}$	[mm/(N/mm²)]	0,14	0,15	0,18	0,20	0,21
Temperature range II:	55°C / 43°C	δ_{N0}	[mm/(N/mm²)]	0,06	0,07	0,09	0,09	0,09
		$\delta_{N\infty}$	[mm/(N/mm²)]	0,15	0,17	0,19	0,21	0,22
Temperature range III:	75°C / 55°C	δ_{N0}	[mm/(N/mm²)]	0,07	0,08	0,09	0,09	0,10
		$\delta_{N\infty}$	[mm/(N/mm²)]	0,16	0,21	0,23	0,24	0,25
Displacement in cracked concrete								
Temperature range I:	40°C / 24°C	δ_{N0}	[mm/(N/mm²)]	0,06	0,10	0,14	0,15	0,16
		$\delta_{N\infty}$	[mm/(N/mm²)]	0,15	0,22	0,19	0,20	0,20
Temperature range II:	55°C / 43°C	δ_{N0}	[mm/(N/mm²)]	0,07	0,12	0,17	0,17	0,19
		$\delta_{N\infty}$	[mm/(N/mm²)]	0,19	0,26	0,23	0,24	0,23
Temperature range III:	75°C / 55°C	δ_{N0}	[mm/(N/mm²)]	0,08	0,13	0,17	0,18	0,20
		$\delta_{N\infty}$	[mm/(N/mm²)]	0,27	0,25	0,26	0,25	0,27

Table 13: Displacements for reinforcing bar (rebar) under tension load in concrete for a service life of 100 years

Reinforcing bar (rebar)				ϕ 8	ϕ 10	ϕ 12	ϕ 14	ϕ 16	ϕ 20	ϕ 25	ϕ 28	ϕ 30	ϕ 32
Displacement in uncracked concrete													
Temperature range I:	40°C / 24°C	δ_{N0}	[mm/(N/mm²)]	0,04	0,05	0,05	0,06	0,06	0,07	0,07	0,08	0,08	0,08
		$\delta_{N\infty}$	[mm/(N/mm²)]	0,12	0,13	0,14	0,16	0,18	0,21	0,21	0,22	0,23	0,24
Temperature range II:	55°C / 43°C	δ_{N0}	[mm/(N/mm²)]	0,05	0,05	0,06	0,07	0,07	0,09	0,09	0,09	0,10	0,10
		$\delta_{N\infty}$	[mm/(N/mm²)]	0,12	0,13	0,14	0,16	0,19	0,21	0,22	0,23	0,24	0,25
Temperature range III:	75°C / 55°C	δ_{N0}	[mm/(N/mm²)]	0,05	0,06	0,07	0,07	0,08	0,09	0,09	0,10	0,10	0,11
		$\delta_{N\infty}$	[mm/(N/mm²)]	0,14	0,15	0,16	0,18	0,21	0,23	0,24	0,25	0,26	0,27
Displacement in cracked concrete													
Temperature range I:	40°C / 24°C	δ_{N0}	[mm/(N/mm²)]	0,02	0,03	0,06	0,08	0,10	0,14	0,15	0,16	0,18	0,19
		$\delta_{N\infty}$	[mm/(N/mm²)]	0,13	0,20	0,21	0,22	0,19	0,21	0,19	0,21	0,24	0,27
Temperature range II:	55°C / 43°C	δ_{N0}	[mm/(N/mm²)]	0,02	0,04	0,07	0,09	0,12	0,17	0,17	0,19	0,21	0,22
		$\delta_{N\infty}$	[mm/(N/mm²)]	0,15	0,24	0,25	0,26	0,23	0,24	0,23	0,25	0,28	0,31
Temperature range III:	75°C / 55°C	δ_{N0}	[mm/(N/mm²)]	0,02	0,04	0,08	0,10	0,13	0,17	0,18	0,20	0,22	0,24
		$\delta_{N\infty}$	[mm/(N/mm²)]	0,17	0,26	0,27	0,28	0,25	0,26	0,25	0,27	0,30	0,33

Table 14: Essential characteristics for threaded rods under tension loads for seismic category C1 in concrete for a service life of 100 years

Threaded rod, HAS-U-…, HIT-V-…, AM…8.8				**M8**	**M10**	**M12**	**M16**	**M20**	**M24**	**M27**	**M30**
Combined pullout and concrete cone failure											
Characteristic resistance in cracked concrete C20/25 in **hammer drilled holes** and **hammer drilled holes with Hilti hollow drill bit TE-CD or TE-YD** and **diamond cored holes with roughening with Hilti Roughening tool TE-YRT**											
Temperature range I:	40°C / 24°C	$\tau_{Rk,C1}$	[N/mm²]	5,0	5,9	6,4	6,2	6,3	5,9	5,5	5,5
Temperature range II:	55°C / 43°C	$\tau_{Rk,C1}$	[N/mm²]	3,6	4,6	4,6	4,6	4,4	4,4	4,0	3,5
Temperature range III:	75°C / 55°C	$\tau_{Rk,C1}$	[N/mm²]	2,0	2,2	2,3	2,4	2,0	2,0	2,0	2,0

Table 15: Essential characteristics for threaded rods under tension loads for seismic category C1 in concrete for a service life of 100 years

Threaded rod, HAS-…, HIT-V-…, size			**[in.]**	**3/8**	**1/2**	**5/8**	**3/4**	**7/8**	**1**	**1 1/4**
Combined pullout and concrete cone failure										
Characteristic resistance in cracked concrete C20/25 in **hammer drilled holes** and **hammer drilled holes with Hilti hollow drill bit TE-CD or TE-YD** and **diamond cored holes with roughening with Hilti Roughening tool TE-YRT**										
Temperature range I:	40°C / 24°C	$\tau_{Rk,C1}$	[N/mm²]	4,8	5,9	6,2	6,5	6,0	6,0	5,5
Temperature range II:	55°C / 43°C	$\tau_{Rk,C1}$	[N/mm²]	3,5	4,1	4,6	4,5	4,5	4,0	3,5
Temperature range III:	75°C / 55°C	$\tau_{Rk,C1}$	[N/mm²]	1,8	2,3	2,4	2,0	2,0	2,0	1,5

Table 16: Essential characteristics for internally threaded sleeve HIS-(R)N under tension load for seismic category C1 in concrete for a service life of 100 years

HIS-(R)N				**M8**	**M10**	**M12**	**M16**	**M20**
Combined pullout and concrete cone failure								
Characteristic resistance in cracked concrete C20/25 in **hammer drilled holes** and **hammer drilled holes with Hilti hollow drill bit TE-CD or TE-YD** and **diamond cored holes with roughening with Hilti Roughening tool TE-YRT**								
Temperature range I:	40°C / 24°C	$\tau_{Rk,C1}$	[N/mm²]	5,2	5,2	5,3	6,0	6,0
Temperature range II:	55°C / 43°C	$\tau_{Rk,C1}$	[N/mm²]	4,3	4,3	4,4	4,5	4,5
Temperature range III:	75°C / 55°C	$\tau_{Rk,C1}$	[N/mm²]	2,4	2,4	2,4	2,5	2,5

Table 17: Essential characteristics for internally threaded sleeve HIS-(R)N under tension load for seismic category C1 in concrete for a service life of 100 years

HIS-(R)N, size			**[in.]**	**3/8**	**1/2**	**5/8**	**3/4**
Combined pullout and concrete cone failure							
Characteristic resistance in cracked concrete C20/25 in **hammer drilled holes** and **hammer drilled holes with Hilti hollow drill bit TE-CD or TE-YD** and **diamond cored holes with roughening with Hilti Roughening tool TE-YRT**							
Temperature range I:	40°C / 24°C	$\tau_{Rk,C1}$	[N/mm²]	5,0	5,1	5,6	5,8
Temperature range II:	55°C / 43°C	$\tau_{Rk,C1}$	[N/mm²]	4,1	4,2	4,2	4,3
Temperature range III:	75°C / 55°C	$\tau_{Rk,C1}$	[N/mm²]	2,3	2,3	2,4	2,4

Table 18: Essential characteristics for Hilti tension anchor HZA / HZA-R under tension load for seismic category C1 in concrete for a service life of 100 years

HZA / HZA-R				**M12**	**M16**	**M20**	**M24**	**M27**
Rebar diameter		ϕ	[mm]	12	16	20	25	28
Combined pullout and concrete cone failure								
Characteristic resistance in cracked concrete C20/25 in **hammer drilled holes** and **hammer drilled holes with Hilti hollow drill bit TE-CD or TE-YD** and **diamond cored holes with roughening with Hilti Roughening tool TE-YRT**								
Temperature range I:	40°C / 24°C	$\tau_{Rk,C1}$	[N/mm^2]	7,4	7,6	7,3	7,4	7,5
Temperature range II:	55°C / 43°C	$\tau_{Rk,C1}$	[N/mm^2]	5,5	5,2	5,3	5,4	5,5
Temperature range III:	75°C / 55°C	$\tau_{Rk,C1}$	[N/mm^2]	2,8	3,5	3,4	3,5	3,5

Table 19: Essential characteristics for reinforcing bars (rebars) under tension load for seismic category C1 in concrete for a service life of 100 years

Reinforcing bar (rebar)				**ϕ 8**	**ϕ 10**	**ϕ 12**	**ϕ 14**	**ϕ 16**	**ϕ 20**	**ϕ 25**	**ϕ 28**	**ϕ 30**	**ϕ 32**
Combined pullout and concrete cone failure													
Characteristic resistance in cracked concrete C20/25 in **hammer drilled holes** and **hammer drilled holes with Hilti hollow drill bit TE-CD or TE-YD** and **diamond cored holes with roughening with Hilti Roughening tool TE-YRT**													
Temperature range I:	40°C / 24°C	$\tau_{Rk,C1}$	[N/mm^2]	[1)]	6,8	7,4	7,4	7,6	7,3	7,4	7,5	7,0	7,0
Temperature range II:	55°C / 43°C	$\tau_{Rk,C1}$	[N/mm^2]	[1)]	5,0	5,5	5,5	5,2	5,3	5,4	5,5	5,0	5,0
Temperature range III:	75°C / 55°C	$\tau_{Rk,C1}$	[N/mm^2]	[1)]	2,7	2,8	3,5	3,5	3,4	3,5	3,5	3,5	3,5

[1)] No performance assessed.