Hilti HIT-RE 500-SD mortar with rebar (as post-installed connection)

Injection mortar system		Benefits
	Hilti HIT-RE 500-SD 330 ml foil pack (also available as 500 ml and 1400 ml foil pack) Statik mixer Rebar	- **SAFEset** technology: drilling and borehole cleaning in one step with Hilti hollow drill bit - suitable for concrete C 12/15 to C 50/60 - high loading capacity - suitable for dry and water saturated concrete - for rebar diameters up to 40 mm - non corrosive to rebar elements - long working time at elevated temperatures - odourless epoxy - suitable for embedment length till 3200 mm

Concrete | Fire resistanc e | Diamond drilled holes | European Technical Approval | Corossion tested | PROFIS Rebar design software | Hilti SAFEset technology with hollow drill bit

Service temperature range

Temperature range: -40°C to +80°C (max. long term temperature +50°C, max. short term temperature +80°C).

Approvals / certificates

Description	Authority / Laboratory	No. / date of issue
European technical approval	DIBt, Berlin	ETA-09/0295 / 2013-05-09
Application document	CSTB, Marne la Vallée	DTA-3/10-649 / 2010-06-17
European technical approval	DIBt, Berlin	ETA-07/0260 / 2013-06-26
Assessment	MFPA Leipzig GmbH	GS 3.2/09-122 / 2010-05-26

[a] All data given in this section according to the approvals mentioned above, ETA-09/0295 issue 2013-05-09 and ETA-07/0260 issue 2013-06-26.

Materials

Reinforcmenent bars according to EC2 Annex C Table C.1 and C.2N.

Properties of reinforcement

Product form		Bars and de-coiled rods	
Class		B	C
Characteristic yield strength f_{yk} or $f_{0,2k}$ (MPa)		400 to 600	
Minimum value of k = $(f_t/f_y)_k$		≥ 1,08	≥ 1,15 < 1,35
Characteristic strain at maximum force, ε_{uk} (%)		≥ 5,0	≥ 7,5
Bendability		Bend / Rebend test	
Maximum deviation from nominal mass (individual bar) (%)	Nominal bar size (mm) ≤ 8 > 8	 ± 6,0 ± 4,5	
Bond: Minimum relative rib area, $f_{R,min}$	Nominal bar size (mm) 8 to 12 > 12	 0,040 0,056	

Setting details

For detailed information on installation see instruction for use given with the package of the product.

Curing time for general conditions

Data according ETA-09/0295, issue 2013-05-09			
Temperature of the base material	Working time in which rebar can be inserted and adjusted t_{gel}	Initial curing time $t_{cure,ini}$	Curing time before rebar can be fully loaded t_{cure}
5 °C ≤ T_{BM} < 10 °C	2 h	18 h	72 h
10 °C ≤ T_{BM} < 15 °C	90 min	12 h	48 h
15 °C ≤ T_{BM} < 20 °C	30 min	9 h	24 h
20 °C ≤ T_{BM} < 25 °C	20 min	6 h	12 h
25 °C ≤ T_{BM} < 30 °C	20 min	5 h	12 h
30 °C ≤ T_{BM} < 40 °C	12 min	4 h	8 h
T_{BM} = 40 °C	12 min	4 h	4 h

For dry concrete curing times may be reduced according to the following table. For installation temperatures below +5 °C all load values have to be reduced according to the load reduction factors given below.

Curing time for dry concrete

Additional Hilti technical data				
Temperature of the base material	Working time in which rebar can be inserted and adjusted t_{gel}	Initial curing time $t_{cure,ini}$	Reduced curing time before rebar can be fully loaded t_{cure}	Load reduction factor
T_{BM} = -5 °C	4 h	36 h	72 h	0,6
T_{BM} = 0 °C	3 h	25 h	50 h	0,7
T_{BM} = 5 °C	2 ½ h	18 h	36 h	1
T_{BM} = 10 °C	2 h	12 h	24 h	1
T_{BM} = 15 °C	1 ½ h	9 h	18 h	1
T_{BM} = 20 °C	30 min	6 h	12 h	1
T_{BM} = 30 °C	20 min	4 h	8 h	1
T_{BM} = 40 °C	12 min	2 h	4 h	1

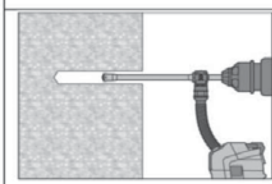
Setting instruction

Safety Regulations:

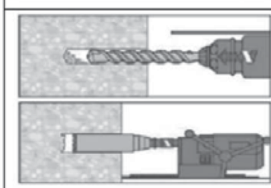
Review the Material Safety Data Sheet (MSDS) before use for proper and safe handling!
Wear well-fitting protective goggles and protective gloves when working with Hilti HIT-RE 500-SD.
Important: Observe the installation instruction of the manufacturer provided with each foil pack.

1. Drill hole

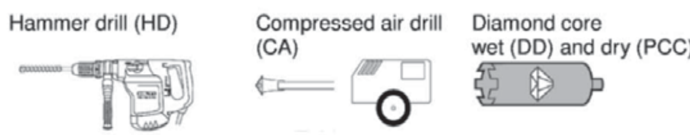
Note: Before drilling, remove carbonized concrete; clean contact areas (see Annex B1)
In case of aborted drill hole the drill hole shall be filled with mortar.



Drill hole to the required embedment depth with an appropriately sized Hilti TE-CD or TE-YD hollow drill bit with Hilti vacuum attachment.
This drilling system removes the dust and cleans the bore hole during drilling when used in accordance with the user's manual.
After drilling is complete, proceed to the "injection preparation" step in the instructions for use.



Drill the hole to the required embedment depth using a hammer-drill with carbid drill bit set in rotation hammer mode, a compressed air drill or a diamond core machine.

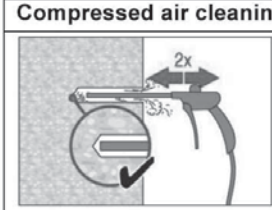


3. Bore hole cleaning

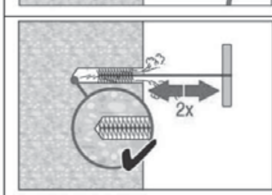
(Not needed with Hilti TE-CD and Hilti TE-YD drill bit)
The borehole must be free of dust, debris, water, ice, oil, grease and other contaminants prior to mortar injection.

Just before setting an anchor, the bore hole must be free of dust and debris by one of two cleaning methods described below

Compressed air cleaning (CAC)

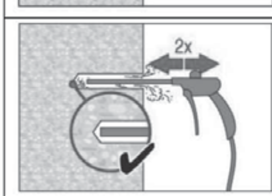


Blowing
2 times from the back of the hole with oil-free compressed air (min. 6 bar at 100 litres per minute (LPM)) until return air stream is free of noticeable dust. Bore hole diameter ≥ 32 mm the compressor must supply a minimum air flow of 140 m^3/hour.
If required use additional accessories and extensions for air nozzle and brush to reach back of hole.



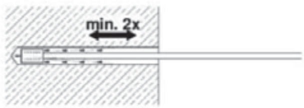
Brushing

2 times with the specified brush HIT-RB size (brush Ø ≥ borehole Ø) by inserting the round steel brush to the back of the hole in a twisting motion. The brush shall produce natural resistance as it enters the anchor hole. If this is not the case, please use a new brush or a brush with a larger diameter.



Blowing

2 times again with compressed air until return air stream is free of noticeable dust.
If required use additional accessories and extensions for air nozzle and brush to reach back of hole.

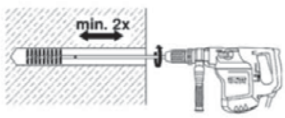


Deep boreholes – Blowing

For boreholes deeper than 250mm (for Ø=8mm – 12mm) or deeper than 20 Ø (for Ø>12mm) use the appropriate air nozzle Hilti HIT-DL

Safety tip: Do not inhale concrete dust.

The application of the dust collector Hilti HIT-DRS is recommended.



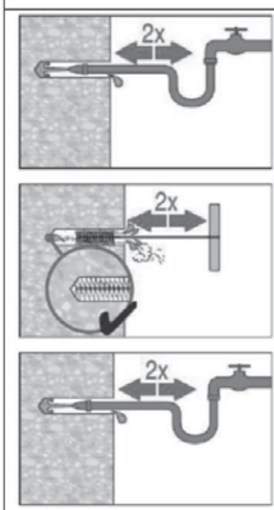
Deep boreholes – Brushing

For boreholes deeper than 250 mm (for Ø=8mm – 12mm) or deeper than 20 Ø (for Ø>12mm) use machine brushing and brush extensions HIT-RBS.

Screw the round steel brush HIT-RB in one end of the brush extension(s) HIT-RBS, so that the overall length of the brush is sufficient to reach the base of the borehole. Attach the other end of the extension to the TE-C/TE-Y chuck.

Safety tip:

- Start machine brushing operational slowly.
- Start brushing operation once brush is inserted in borehole.

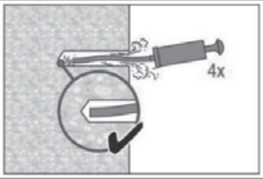


In addition for wet diamond coring (DD):

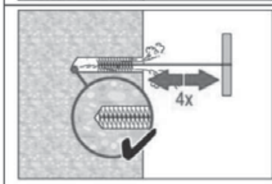
For wet diamond coring please observe the following steps in addition **prior to** compressed air cleaning:

Remove all core fragments from the anchor hole. Flush the anchor hole with clear running water until water runs clear. Brush the anchor hole again 2 times with the appropriate sized brush over the entire depth of the anchor hole. Repeat the flushing process until water runs out of the anchor hole.

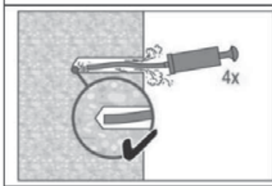
Manual Cleaning (MC) Manual cleaning is permitted for hammer drilled boreholes up to hole diameters $d_0 \leq$ 20mm and depths $\mathbf{l}_v$ resp. $\mathbf{l}_{e,ges.} \leq$ 160mm.



Blowing
4 strokes with Hilti blow-out pump from the back of the hole until return air stream is free of noticeable dust.



Brushing
4 times with the specified brush HIT_RB size (brush Ø ≥ borehole Ø) by inserting the round steel wire brush to the back of the hole with a twisting motion. The brush shall produce natural resistance as it enters the anchor hole. If this is not the case, please use a new brush or a brush with a larger diameter.

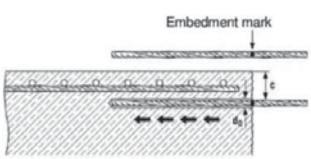


Blowing
4 strokes with Hilti blow-out pump from the back of the hole until return air stream is free of noticeable dust.

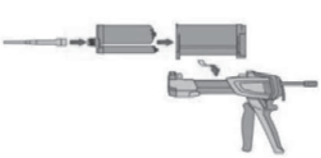
Manual Cleaning (MC)

Hilti hand pump recommended for blowing out bore hole with diameters d<20mm and bore hole depth h_0<160mm

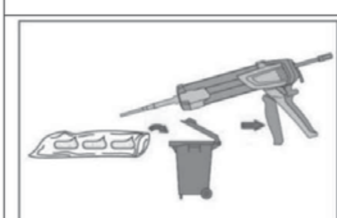
3.Rebar preparation and foil pack preparation



Before use, make sure the rebar is dry and free of oil or other residue.
Mark the embedment depth on the rebar. (e.g. with tapte) , $\mathbf{l}_v$
Insert rebar in borehole, to verify hole and setting depth $\mathbf{l}_v$ resp. $\mathbf{l}_{e,ges}$



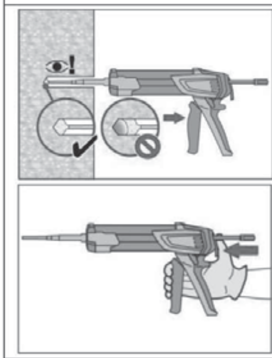
- Observe the Instruction for Use of the dispenser and the mortar.
- Tightly attach Hilti HIT-RE-M mixing nozzle to foil pack manifold.
- Insert foil pack into foil pack holder and swing holder into the dispenser.



Discard initial mortar. The foil pack opens automatically as dispensing is initiated. Depending on the size of the foil pack an initial amount of adhesive has to be discarded.
After changing a mixing nozzle, the first few trigger pulls must be discarded as decribed above. For each new foil pack a new mixing nozzle must be used.
Discard quantities are
3 strokes for 330 ml foil pack,
4 strokes for 500 ml foil pack,
65 ml for 1400 ml foil pack,

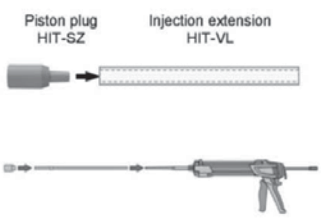
4.Inject mortar into borehole Forming air pockets be avoided

4.1 Injection method for borehole depth ≤ 250 mm

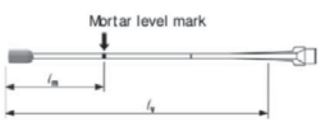


Inject the mortar from the back of the hole towards the front and slowly withdraw the mixing nozzle step by step after each trigger pull.
Fill holes approximately 2/3 full, or as required to ensure that the annular gap between the rebar and the concrete is completely filled with adhesive over the embedment length.
After injecting, depressurize the dispenser by pressing the release trigger. This will prevent further mortar discharge from the mixing nozzle.

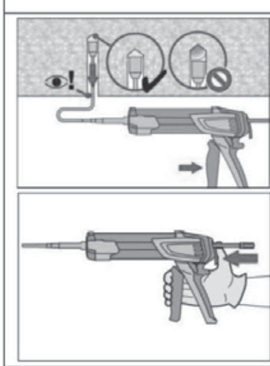
4.2 Injection method for borehole depth > 250 mm or overhead application



Assemble mixing nozzle HIT-RE-M, extension(s) and piston plug HIT-SZ.
For combinations of several injection extansions use coupler HIT-VL K. A substitution of the injection extansion for a plastic hose or a combination of both is permitted.
The combination of HIT-SZ piston plug with HIT-VL 16 pipe and then HIT-VL 16 tube support proper injection.

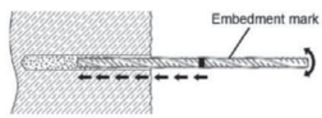


Mark the required mortar level $\mathbf{l}_m$ and embedment depth $\mathbf{l}_b$ resp. $\mathbf{l}_{e,ges}$ with tape or marker on the injection extension.

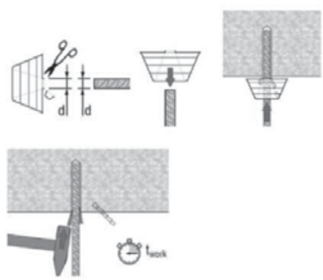


Insert piston plug to back of the hole. Begin injection allowing the pressure of the injected adhesive mortar to push the piston plug towards the front of the hole.
Fill holes approximately 2/3 full, or as required to ensure that the annular gap between the rebar and the concrete is completely filled with adhesive over the embedment length.
Injection until the morat level mark $\mathbf{l}_m$ becomes visible.
After injecting, depressurize the dispenser by pressing the release trigger. This will prevent further mortar discharge from the mixing nozzle.

5.Insert rebar



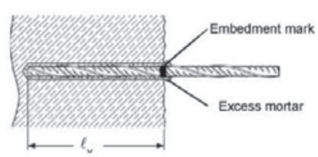
For easy installation insert the rebar slowly twisted into the boreholeuntil the embedment mark is at the concrete surface level.



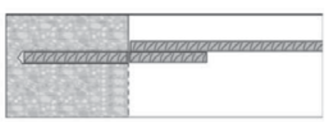
Overhead application:

During insertion of the rebar, mortar might flow out of the borehole. For collection of the flowing mortar, HIT-OHC may be used.

Support the rebar and secure it from falling till mortar started to harden, e.g. using wedges HIT-OHW.



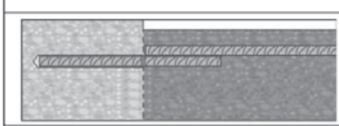
After installing the rebar the annular gap must be completely filled with mortar.



After installing the rebar the annular gap must be completely filled with mortar.

Proper installation can be verified when:

Desired anchoring embedment is reached $\mathbf{l}_v$: embedment mark at concrete surface.
Excess mortar flows out of the borehole after the rebar has been fully inserted until the embedment mark.



Full load may be applied only after the curing time "t_{cure}" has elapsed.

Fitness for use

Some creep tests have been conducted in accordance with ETAG guideline 001 part 5 and TR 023 in the following conditions : in dry environnement at 50 °C during 90 days.
These tests show an excellent behaviour of the post-installed connection made with HIT-RE 500-SD: low displacements with long term stability, failure load after exposure above reference load.

Resistance to chemical substances

Categories	Chemical substances	Resistant	Non resistant
Alkaline products	Drilling dust slurry pH = 12,6	+	
	Potassium hydroxide solution (10%) pH = 14	+	
Acids	Acetic acid (10%)		+
	Nitric acid (10%)		+
	Hydrochloric acid (10%)		+
	Sulfuric acid (10%)		+
Solvents	Benzyl alcohol		+
	Ethanol		+
	Ethyl acetate		+
	Methyl ethyl keton (MEK)		+
	Trichlor ethylene		+
	Xylol (mixture)	+	
Products from job site	Concrete plasticizer	+	
	Diesel	+	
	Engine oil	+	
	Petrol	+	
	Oil for form work	+	
Environnement	Sslt water	+	
	De-mineralised water	+	
	Sulphurous atmosphere (80 cycles)	+	

Electrical Conductivity

HIT-RE 500-SD in the hardened state **is not conductive electrically**. Its electric resistivity is $66 \cdot 10^{12}$ Ω.m (DIN IEC 93 – 12.93). It is adapted well to realize electrically insulating anchorings (ex: railway applications, subway).

Drilling diameters

Rebar (mm)	Drill bit diameters d_0 [mm]			
	Hammer drill (HD) Hollow Drill Bit (HDB)	Compressed air drill (CA)	Diamond coring	
			Wet (DD)	Dry (PCC)
8	12 (10 [a])	-	12 (10 [a])	-
10	14 (12 [a])	-	14 (12 [a])	-
12	16 (14 [a])	17	16 (14 [a])	-
14	18	17	18	-
16	20	20	20	-
18	22	22	22	-
20	25	26	25	-
22	28	28	28	-
24	32	32	32	35
25	32	32	32	35
26	35	35	35	35
28	35	35	35	35
30	37	35	37	35
32	40	40	40	47
34	45	42	42	47
36	45	45	47	47
40	55	57	52	52

a) Max. installation length l = 250 mm.

Basic design data for rebar design according to rebar ETA

Bond strength in N/mm² according to ETA 09/0295 for good bond conditions for hammer drilling, compressed air drilling, dry diamond core drilling

Rebar (mm)	Concrete class								
	C12/15	C16/20	C20/25	C25/30	C30/37	C35/45	C40/50	C45/55	C50/60
8 - 32	1,6	2,0	2,3	2,7	3,0	3,4	3,7	4,0	4,3
34	1,6	2,0	2,3	2,6	2,9	3,3	3,6	3,9	4,2
36	1,5	1,9	2,2	2,6	2,9	3,3	3,6	3,8	4,1
40	1,5	1,8	2,1	2,5	2,8	3,1	3,4	3,7	4,0

Bond strength in N/mm² according to ETA 09/0295 for good bond conditions for wet diamond core drilling

Rebar (mm)	Concrete class								
	C12/15	C16/20	C20/25	C25/30	C30/37	C35/45	C40/50	C45/55	C50/60
8 - 25	1,6	2,0	2,3	2,7	3,0	3,4	3,7	4,0	4,3
26 - 32	1,6	2,0	2,3	2,7	2,7	2,7	2,7	2,7	2,7
34	1,6	2,0	2,3	2,6	2,6	2,6	2,6	2,6	2,6
36	1,5	1,9	2,2	2,6	2,6	2,6	2,6	2,6	2,6
40	1,5	1,8	2,1	2,5	2,5	2,5	2,5	2,5	2,5

Pullout design bond strength for Hit Rebar design

Design bond strength in N/mm² according to ETA 07/0260 (values in table are design values, $f_{bd,po} = \tau_{Rk}/\gamma_{Mp}$

<table>
<tr><td colspan="16">Hammer or compressed air drilling.
Water saturated, water filled or submerged hole.
Uncracked concrete C20/25.</td></tr>
<tr><td rowspan="3">temperature range</td><td colspan="15">Bar diameter</td></tr>
<tr><td colspan="13">Data according to ETA 04/0027</td><td colspan="2">Hilti tech data</td></tr>
<tr><td>8</td><td>10</td><td>12</td><td>14</td><td>16</td><td>20</td><td>22</td><td>24</td><td>25</td><td>26</td><td>28</td><td>30</td><td>32</td><td>36</td><td>40</td></tr>
<tr><td>I: 40°C/24°C</td><td colspan="3">7,1</td><td colspan="3">6,7</td><td colspan="7">6,2</td><td>5,2</td><td>4,8</td></tr>
<tr><td>II: 58°C/35°C</td><td colspan="4">5,7</td><td colspan="6">5,2</td><td colspan="3">4,8</td><td>4,3</td><td>3,8</td></tr>
<tr><td>III: 70°C/43°C</td><td colspan="5">3,3</td><td colspan="5">3,1</td><td colspan="3">2,9</td><td colspan="2">2,4</td></tr>
</table>

Increasing factor in non-cracked concrete: $f_{B,p}=(f_{cck}/25)^{0,1}$ (f_{cck}: characteristic compressive strength on cube)

Additional Hilti Technical Data:

If the concrete is dry (not in contact with water before/during installation and curing), the pullout design bond strength may be increased by 20%.

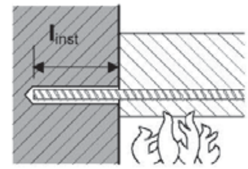
If the hole was produced by wet diamond coring, the pullout design bond strength has to be reduced by 30%.

Reduction factor for splitting with large concrete cover: δ = 0,306 (Hilti additional data)

Fire Resistance

according to MFPA Leipzig, report GS 3.2/09-122

a) fire situation "anchorage"



Maximum force in rebar in conjunction with HIT-RE 500 SD as a function of embedment depth for the fire resistance classes F30 to F240 (yield strength f_{yk} = 500 N/mm²) according EC2[a).]

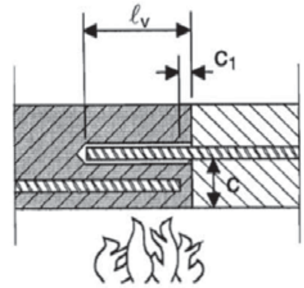
Bar Ø	Drill hole Ø	Max. $F_{s,T}$	l_{inst}	Fire resistance of bar in [kN]					
[mm]	[mm]	[kN]	[mm]	R30	R60	R90	R120	R180	R240
8	10	16,19	65	1,38	0,57	0,19	0,05	0	0
			80	2,35	1,02	0,47	0,26	0	0
			95	3,87	1,68	0,88	0,55	0,12	0
			115	7,30	3,07	1,71	1,14	0,44	0,18
			150	16,19	8,15	4,59	3,14	1,41	0,8
			180		16,19	9,99	6,75	2,94	1,7
			205			16,19	12,38	5,08	2,86
			220				16,19	6,95	3,82
			265					16,19	8,57
			305						16,19
10	12	25,29	80	2,94	1,27	0,59	0,33	0	0
			100	5,68	2,45	1,31	0,85	0,24	0
			120	10,66	4,44	2,48	1,68	0,68	0,31
			140	17,57	7,76	4,38	2,99	1,33	0,73
			165	25,29	15,06	8,5	5,79	2,58	1,5
			195		25,29	17,63	12,18	5,12	2,93
			220			25,29	20,66	8,69	4,78
			235				25,29	11,8	6,30
			280					25,29	13,86
			320						25,29
12	16	36,42	95	5,80	2,52	1,32	0,83	0,18	0
			120	12,79	5,33	2,97	2,01	0,82	0,37
			145	23,16	10,68	6,02	4,12	1,84	1,03
			180	36,42	24,29	14,99	10,12	4,41	2,55
			210		36,42	27,38	20,65	8,47	4,74
			235			36,42	31,01	14,16	7,56
			250				36,42	19,13	9,89
			295					36,42	21,43
			335						36,42
14	18	49,58	110	10,92	4,65	2,55	1,70	0,61	0,20
			140	24,60	10,87	6,13	4,19	1,86	1,03
			170	39,12	23,50	13,55	9,20	4,07	2,37
			195	49,58	35,6	24,69	17,05	7,17	4,10
			225		49,58	39,20	31,34	13,48	7,34
			250			49,58	43,44	22,32	11,54
			265				49,58	29,49	15,00
			310					49,58	31,98
			350						49,58

Bar ∅	Drill hole ∅	Max. $F_{s,T}$	l_{inst}	Fire resistance of bar in [kN]					
[mm]	[mm]	[kN]	[mm]	R30	R60	R90	R120	R180	R240
16	20	64,75	130	22,59	9,42	5,30	3,61	1,56	0,80
			160	39,17	21,33	11,95	8,15	3,65	2,11
			190	55,76	37,92	24,45	17,25	7,35	4,22
			210	64,75	48,98	36,51	27,53	11,29	6,32
			240		64,75	53,10	44,12	20,88	11,04
			265			64,75	57,94	33,7	17,14
			280				64,75	42,0	22,17
			325					64,75	44,84
			365						64,75
20	25	101,18	160	48,97	26,67	14,93	10,18	4,56	2,64
			200	76,61	54,31	38,73	27,5	11,42	6,48
			240	101,18	81,96	66,37	55,15	26,10	13,8
			270		101,18	87,11	75,88	45,58	23,36
			295			101,18	93,16	62,86	35,72
			310				101,18	73,23	45,69
			355					101,18	76,79
			395						101,18
25	30	158,09	200	95,77	67,89	48,41	34,37	14,27	8,10
			250	138,96	111,09	91,60	77,51	39,86	20,61
			275	158,09	132,69	113,2	99,17	61,30	31,81
			305		158,09	139,12	125,09	87,22	52,79
			330			158,09	146,69	108,82	74,39
			345				158,09	121,77	87,34
			390					158,09	126,22
			430						158,09
32	40	259,02	255	183,40	147,72	122,78	104,82	56,35	28,80
			275	205,52	169,84	144,90	126,94	78,46	40,71
			325	259,02	225,13	200,19	182,23	133,75	89,68
			368		259,02	238,89	220,93	172,46	128,39
			380			259,02	243,05	194,58	150,51
			395				259,02	211,16	167,09
			440					259,02	216,86
			480						259,02
36	42 - 46	327,82	290	249,87	209,73	181,67	161,46	106,93	59,10
			325	293,41	253,27	225,21	205,01	150,47	100,89
			355	327,82	290,59	262,54	242,33	187,80	138,22
			385		327,82	299,86	279,65	225,12	175,54
			410			327,82	310,75	256,22	206,64
			425				327,82	274,88	225,30
			470					327,82	281,28
			510						327,82
40	47	404,71	320	319,10	274,50	243,33	220,87	160,28	105,19
			355	367,48	322,88	291,71	269,25	208,66	153,57
			385	404,71	364,35	333,18	310,72	250,13	195,04
			415		404,71	374,64	352,19	291,60	236,51
			440			404,71	386,75	326,16	271,07
			455				404,71	346,89	291,80
			500					404,71	354,01
			540						404,71

b) bar connection parallel to slab or wall surface exposed to fire

Max. bond stress, τ_T, depending on actual clear concrete cover for classifying the fire resistance.

It must be verified that the actual force in the bar during a fire, $F_{s,T}$, can be taken up by the bar connection of the selected length, $\mathbf{l}_{inst}$. Note: Cold design for ULS is mandatory.



$F_{s,T} \leq (\mathbf{l}_{inst} - c_f) \cdot \phi \cdot \pi \cdot \tau_T$ where: $(\mathbf{l}_{inst} - c_f) \geq \mathbf{l}_s$;

$\mathbf{l}_s$ = lap length

ϕ = nominal diameter of bar

$\mathbf{l}_{inst} - c_f$ = selected overlap joint length; this must be at least $\mathbf{l}_s$, but may not be assumed to be more than 80 ϕ

τ_T = bond stress when exposed to fire

Critical temperature-dependent bond stress, τ_c, concerning "overlap joint" for Hilti HIT-RE 500-SD injection adhesive in relation to fire resistance class and required minimum concrete coverage c.

Clear concrete cover c	Max. bond stress, τ_c [N/mm²]					
[mm]	R30	R60	R90	R120	R180	R240
10	0					
20	0,49	0				
30	0,66		0			
40	0,89	0,48		0		
50	1,21	0,62			0	
60	1,63	0,80	0,51			0
70	2,19	1,04	0,65	0,49		
80	2,96	1,35	0,83	0,61		
90	3,99	1,75	1,06	0,77	0,45	
100	5,38	2,26	1,36	0,97	0,55	
110	7,25	2,93	1,73	1,23	0,67	0,47
120	9,78	3,79	2,21	1,55	0,81	0,55
130		4,91	2,81	1,96	0,98	0,64
140		6,35	3,59	2,47	1,18	0,76
150		8,22	4,58	3,12	1,43	0,89
160		10,65	5,84	3,94	1,73	1,04
170			7,45	4,97	2,10	1,23
180			9,51	6,27	2,54	1,44
190				7,91	3,07	1,69
200				9,99	3,71	1,99
210					4,49	2,34
220	11,00				5,44	2,75
230					6,58	3,22
240		11,00			7,96	3,79
250			11,00		9,64	4,45
260				11,00		5,23
270						6,14
280					11,00	7,21
290						8,47
300						9,95
310						11,00

Basic design data for seismic rebar design

Bond strength $f_{bd,seism}$ in N/mm² according to DTA-3/10-649 for good bond conditions
for hammer drilling, compressed air drilling, dry diamond core drilling

Rebar (mm)	Concrete class					
	C20/25	C25/30	C30/37	C35/45	C40/50	C45/55
8	2,3	2,7	3,0	3,4	3,7	4,0
10	2,3	2,7	3,0	3,4	3,7	4,0
12	2,3	2,7	3,0	3,4	3,7	3,7
14	2,3	2,7	3,0	3,4	3,7	3,7
16	2,3	2,7	3,0	3,4	3,7	3,7
18	2,3	2,7	3,0	3,4	3,7	3,7
20	2,3	2,7	3,0	3,4	3,7	3,7
22	2,3	2,7	3,0	3,0	3,4	3,4
24	2,3	2,7	3,0	3,0	3,4	3,4
25	2,3	2,7	3,0	3,0	3,4	3,4
26	2,3	2,7	3,0	3,0	3,0	3,0
28	2,3	2,7	3,0	3,0	3,0	3,0
30	2,3	2,7	3,0	3,0	3,0	3,0
32	2,3	2,7	3,0	3,0	3,0	3,0
34	2,3	2,6	2,9	2,7	2,7	2,7
36	2,2	2,6	2,9	2,7	2,7	2,7
40	2,1	2,5	2,7	2,7	2,7	2,7

Minimum anchorage length

The multiplication factor for minimum anchorage length shall be considered as 1,0 for all drilling methods.

Minimum anchorage and lap lengths for C20/25; maximum hole lengths (ETA 09/0295)

Rebar		Hammer drilling, Compressed air drilling, Dry diamond coring drilling		Wet diamond coring drilling		
Diameter d_s [mm]	$f_{y,k}$ [N/mm²]	$l_{b,min}$* [mm]	$l_{0,min}$ * [mm]	$l_{b,min}$* [mm]	$l_{0,min}$ * [mm]	l_{max} [mm]
8	500	113	200	170	300	1000
10	500	142	200	213	300	1000
12	500	170	200	255	300	1200
14	500	198	210	298	315	1400
16	500	227	240	340	360	1600
18	500	255	270	383	405	1800
20	500	284	300	425	450	2000
22	500	312	330	468	495	2200
24	500	340	360	510	540	2400
25	500	354	375	532	563	2500
26	500	369	390	553	585	2600
28	500	397	420	595	630	2800
30	500	425	450	638	675	3000
32	500	454	480	681	720	3200
34	500	492	510	738	765	3200
36	500	532	540	797	810	3200
40	500	616	621	925	932	3200

$l_{b,min}$ (8.6) and $l_{0,min}$ (8.11) are calculated for good bond conditions with maximum utilisation of rebar yield strength f_{yk} = 500 N/mm² and α_6 = 1,0