HIT-HY 200 injection mortar

Rebar design (EN 1992-1) / Rebar elements / Concrete

Injection mortar system

Hilti HIT-HY 200-R
330 ml foil pack
(also available as
500 ml foil pack)

Hilti HIT-HY 200-A
330 ml foil pack
(also available as
500 ml foil pack)

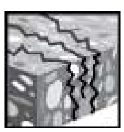
Rebar
(ϕ8 - ϕ32)

Benefits

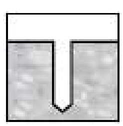
- **SafeSet** technology: Hilti hollow drill bit for hammer drilling
- HY 200-R version is formulated for best handling and cure time specifically for rebar applications
- Approved for ETA seismic C1 approval for post-installed-rebar
- Suitable for concrete C 12/15 to C 50/60
- Suitable for dry and water saturated concrete
- For rebar diameters up to 32 mm
- Non corrosive to rebar elements
- Good load capacity at elevated temperatures
- Suitable for embedment length up to 1000 mm
- Suitable for applications down to -10 °C
- Two mortar versions: HY 200-A for slow cure applications and HY 200-R for fast cure applications

Base material

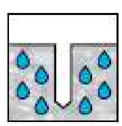
Concrete (non-cracked)



Concrete (cracked)

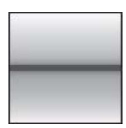


Dry concrete

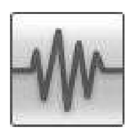


Wet concrete

Load conditions



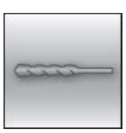
Static/ quasi-static



Seismic, CSTB[1]/ETA-C1[2]

Fire resistance

Installation conditions



Hammer drilling

Hilti Safe**Set** technology

Other informations

European Technical Assessment

CE conformity

PROFIS Rebar design Software

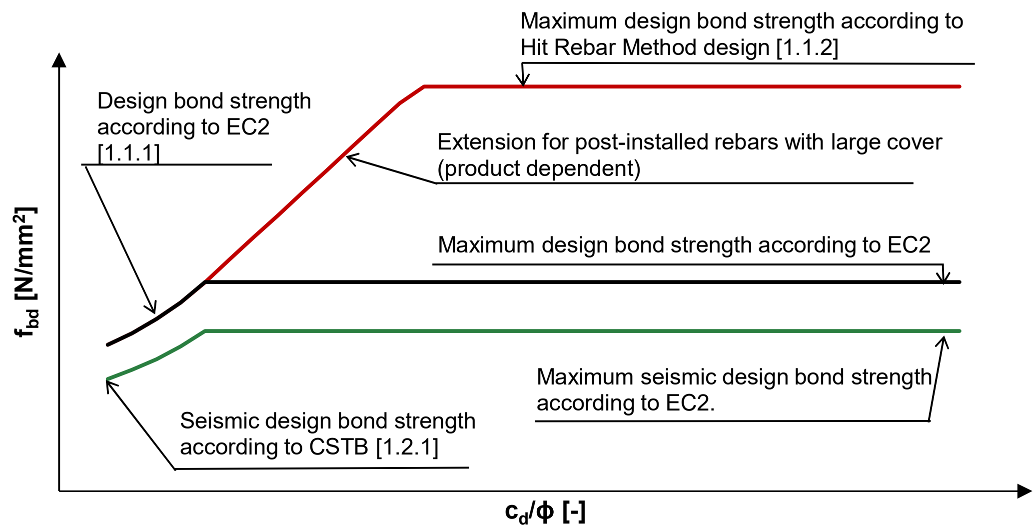
[1]Seismic data only valid for HY 200-A
[2]Seismic data only valid for HY 200 R

Approvals / certificates

Description	Authority / Laboratory	No. / date of issue
European technical Assessment [a]	DIBt, Berlin	ETA-11/0492/ 2014-06-26 (HY200 A)
European technical Assessment [a]	DIBt, Berlin	ETA-12/0083/ 2018-06-26 (HY200 R)
Assessment (fire)	CSTB, Marne la Vallée	Z-21.8-1948 / 2013-11-14 (HY200 A)
Assessment (fire)	CSTB, Marne la Vallée	Z-21.8-1947 / 2014-07-22 (HY200 R)

[a] All data given in this section according to ETA-11/0492, issue 2014-06-26 and ETA-12/0083, issue 2014-06-26,.

Static and quasi-static loading



Effective limit on bond stress for post-installed rebar using Hilti mortar systems and design bond strength values as provided by the EC2.

Static EC2 design (small concrete cover)

Design bond strength in N/mm² for good bond conditions

All allowed drilling methods									
Rebar - size	Concrete class								
	C12/15	C16/20	C20/25	C25/30	C30/37	C35/45	C40/50	C45/55	C50/60
ϕ8 - ϕ32	1,6	2,0	2,3	2,7	3,0	3,4	3,7	4,0	4,3

For poor bond conditions multiply the values by 0,7. Values valid for non-cracked and cracked concrete.

Static Hit Rebar Method design (large concrete cover)

Maximum design bond strength in N/mm² for good bond conditions

Non-cracked concrete, all allowed drilling methods								
Temperature range	Rebar - size	Concrete class						
		C20/25	C25/30	C30/37	C35/45	C40/45	C45/55	C50/60
I: 40°C/24°C	ϕ8 - ϕ32	8	8,2	8,3	8,4	8,6	8,7	8,8
II: 58°C/35°C		6,7	6,8	6,9	7,0	7,1	7,2	7,3
III: 70°C/43°C		5,7	5,8	5,9	6,0	6,1	6,1	6,2
Cracked concrete, all allowed drilling methods								
I: 40°C/24°C	ϕ12 - ϕ32	4,7	4,8	4,8	4,9	5,0	5,1	5,1
II: 58°C/35°C		3,7	3,7	3,8	3,9	3,9	4,0	4,0
III: 70°C/43°C		3,3	3,4	3,5	3,5	3,6	3,6	3,7

For poor bond conditions multiply the values by 0,7. *The reduction factor for rebar diameter equal to 10 mm is 0,72

Additional Hilti Technical Data:

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

Minimum anchorage length and minimum lap length

The minimum anchorage length $\ell_{b,min}$ and the minimum lap length $\ell_{0,min}$ according to EN 1992-1-1 shall be multiplied by relevant **Amplification factor α_{lb}** in the table below.

Amplification factor α_{lb} for the min. anchorage length and min. lap length for

All allowed hammer drilling methods									
Rebar - size	Concrete class								
	C12/15	C16/20	C20/25	C25/30	C30/37	C35/45	C40/50	C45/55	C50/60
ϕ8 - ϕ32	1,0								

Anchorage length for characteristic steel strength f_{yk}=500 N/mm² for good conditions

All allowed drilling methods									
Rebar-size	Concrete class	Yielding load [kN]	$l_{b,min}$ 1) [mm]	$l_{0,min}$ 1) [mm]	$l_{bd,y}$ (α_2=1) 2) [mm]	$l_{bd,y}$ (α_2=0.7) 3) [mm]	$l_{bd,y,HRM}$ (α_2<0.7) 4) [mm]	l_{max} -10°C ≤ Ct 5) ≤ 0°C [mm]	l_{max} Ct 5) > 0°C [mm]
ϕ8	C20/25	21,9	113	200	378	265	109	700	1000
ϕ8	C50/60	21,9	100	200	202	142	99	700	1000
ϕ10	C20/25	34,1	142	200	473	331	136	700	1000
ϕ10	C50/60	34,1	100	200	253	177	124	700	1000
ϕ12	C20/25	49,2	170	200	567	397	163	700	1000
ϕ12	C50/60	49,2	120	200	303	212	148	700	1000
ϕ14	C20/25	66,9	198	210	662	463	190	700	1000
ϕ14	C50/60	66,9	140	210	354	248	173	700	1000
ϕ16	C20/25	87,4	227	240	756	529	217	700	1000
ϕ16	C50/60	87,4	160	240	404	283	198	700	1000
ϕ18	C20/25	110,6	255	270	851	595	245	700	1000
ϕ18	C50/60	110,6	180	270	455	319	222	700	1000
ϕ20	C20/25	136,6	284	300	945	662	272	700	1000
ϕ20	C50/60	136,6	200	300	506	354	247	700	1000
ϕ22	C20/25	165,3	312	330	1040	728	299	700	1000
ϕ22	C50/60	165,3	220	330	556	389	272	700	1000
ϕ24	C20/25	196,7	340	360	1134	794	326	700	1000
ϕ24	C50/60	196,7	240	360	607	425	296	700	1000
ϕ25	C20/25	213,4	354	375	1181	827	340	700	1000
ϕ25	C50/60	213,4	250	375	632	442	309	700	1000
ϕ26	C20/25	230,8	369	390	1229	860	353	700	1000
ϕ26	C50/60	230,8	260	390	657	460	321	700	1000
ϕ28	C20/25	267,7	397	420	1323	926	380	700	1000
ϕ28	C50/60	267,7	280	420	708	495	346	700	1000
ϕ30	C20/25	307,3	425	450	1418	992	408	700	1000
ϕ30	C50/60	307,3	300	450	758	531	371	700	1000
ϕ32	C20/25	349,7	454	480	1512	1059	435	700	1000
ϕ32	C50/60	349,7	320	480	809	566	395	700	1000

1) According to EC2: EN 1992-1-1:2004 $l_{b,min}$ (8.6) and $l_{0,min}$ (8.11) are calculated for good bond conditions with characteristic yield strength f_{yk} = 500 N/mm², γ_M=1,15 and α_6 = 1,0
2) Embedment depth for yield of the rebar and for c_d/ϕ = 1 (characteristic yield strength f_{yk} = 500 N/mm²)
3) Embedment depth for yield of the rebar and for c_d/ϕ = 3 (characteristic yield strength f_{yk} = 500 N/mm²)
4) Embedment depth according to Hit Rebar design for yield of the rebar and for c_d/ϕ > 8 (Temperature range I,
5) characteristic yield strength f_{yk} = 500 N/mm²)
6) c_t=concrete temperature

Seismic data

Seismic data according to ETA-12/0083 assessment

Seismic reduction factor $k_{b,seis}$ for hammer drilling (HD) and (HDB) and compressed air drilling (CA)

Rebar - size	Reduction factor $k_{b,seis}$							
	Concrete class							
	C16/20	C20/25	C25/30	C30/37	C35/45	C40/50	C45/55	C50/60
ϕ12 - ϕ18	1,0				0,90	0,82	0,76	0,71
ϕ20 - ϕ30	1,0						0,92	0,86
ϕ32	1,0							

For poor bond conditions multiply the values 0,7.

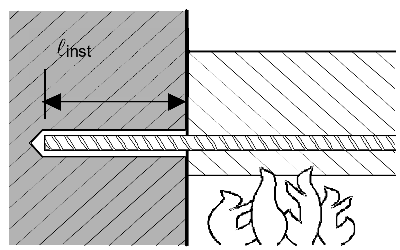
Design values for the ultimate bond resistance $f_{bd,seis}$ [1)] in N/mm² for seismic loading for hammer drilling (HD) and (HDB) and compressed air drilling (CA)

Rebar - size		Bond resistance $f_{bd,seis}$						
		Concrete class						
	C16/20	C20/25	C25/30	C30/37	C35/45	C40/50	C45/55	C50/60
ϕ12 - ϕ18	2,0	2,3	2,7	3,0				
ϕ20 - ϕ30	2,0	2,3	2,7	3,0	3,4	3,7		
ϕ32	2,0	2,3	2,7	3,0	3,4	3,7	4,0	4,3

1) **According to EN 1992-1-1:2004 for good bond conditions. For all other bond conditions multiply the values by 0.7.**

Fire resistance

a) Anchoring application



Maximum force ($F_{s,T,max}$) in rebar in conjunction with HIT-HY 200 as a function of embedment depth (ℓ_{inst}) for the fire resistance classes F30 to F180 according to EC2.

Rebar-size	$F_{s,T,max}$ [kN]	ℓ_{inst} [mm]	Fire resistance of bar [kN]				
			R30	R60	R90	R120	R180
		80	3,0	0,7	0,2	0,0	0,0
		120	7,0	2,2	1,3	0,7	0,2
		170		10,2	9,2	4,0	1,7
ϕ8	16,19	210				11,0	7,5
		230	*16,2*	*16,2*	*16,2*	14,5	10,9
		250				*16,2*	14,5
		300					*16,2*
		100	6,1	2,0	1,0	0,4	0,0
		150	19,3	9,3	7,1	2,2	1,0
		190		18,0	15,9	9,3	4,9
ϕ10	25,29	230			24,7	18,1	13,7
		260	*25,3*	*25,3*		24,7	20,3
		280			*25,3*	*25,3*	24,7
		320					*25,3*
ϕ12	36,42	120	15,3	6,0	1,9	1,1	0,3
		180	31,0	19,0	17,8	8,5	7,0

Maximum force ($F_{s,T,max}$) in rebar in conjunction with HIT-HY 200 as a function of embedment depth (ℓ_{inst}) for the fire resistance classes F30 to F180 according to EC2

ϕ12	**36,42**	220	*36,4*	29,6	27,0	19,1	13,8
		260		*36,4*	*36,4*	29,7	24,4
		280				35,0	29,6
		300				*36,4*	34,9
		340					*36,4*
ϕ14	**49,58**	140	24,0	9,9	6,9	2,6	1,0
		210	45,0	31,4	28,5	25,7	13,0
		240	*49,6*	40,6	37,7	32,8	22,3
		280		*49,6*	*49,6*	40,7	34,6
		300				44,7	40,7
		330				*49,6*	48,1
		360					*49,6*
ϕ16	**64,75**	160	34,5	18,4	14,9	4,4	2,3
		240	62,6	46,4	43,0	37,7	25,5
		260	*64,8*	53,5	50,0	44,7	32,5
		300		*64,8*	57,0	51,7	49,6
		330			*64,8*	61,3	57,2
		360				*64,8*	62,7
		400					*64,8*
20	**101,18**	200	60,7	40,0	36,3	29,3	14,3
		250	78,3	62,5	58,3	51,3	36,3
		310	*101,2*	88,9	84,6	77,6	62,6
		350		*101,2*	*101,2*	94,2	80,2
		370				*101,2*	83,5
		390					97,8
		430					*101,2*
ϕ25	**158,09**	250	97,9	78,1	72,6	64,7	45,3
		280	126,5	94,6	89,4	81,2	61,8
		370	*158,1*	144,0	127,9	119,7	111,2
		410		*158,1*	150,0	141,8	123,2
		430			*158,1*	150,0	144,2
		450				*158,1*	155,2
		500					*158,1*
ϕ32	**158,09**	250	97,9	78,1	72,6	64,7	45,3
		280	126,5	94,6	89,4	81,2	61,8
		370	*158,1*	144,0	127,9	119,7	111,2
		410		*158,1*	150,0	141,8	123,2
		430			*158,1*	150,0	144,2
		450				*158,1*	155,2
		500					*158,1*

Characteristic yield strength f_{yk} = 500 N/mm²

Steel failure

b) Overlap joint application

Max. bond stress, $f_{bd,FIRE}$, 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, ℓ_{inst}. Note: Cold design for ULS is mandatory.

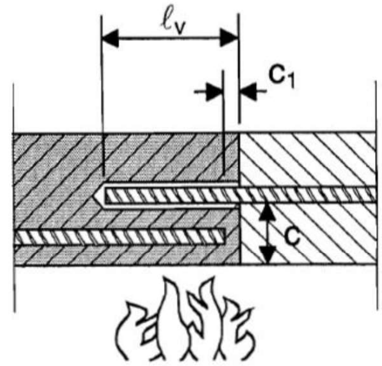
$F_{s,T} \leq (\ell_{inst} - c_f) \cdot \phi \cdot \pi \cdot f_{bd,FIRE}$ where: $(\ell_{inst} - c_f) \geq \ell_s$;

ℓ_s = lap length

ϕ = nominal diameter of bar

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

$f_{bd,FIRE}$ = bond stress when exposed to fire



Critical temperature-dependent bond stress, τ_c, concerning "overlap joint" for Hilti HIT-HY 200 injection adhesive in relation to fire resistance class and required minimum concrete coverage c.

<table>
<tr><th>Clear concrete cover c</th><th colspan="5">Max. bond stress, τc [N/mm²]</th></tr>
<tr><th>[mm]</th><th>R30</th><th>R60</th><th>R90</th><th>R120</th><th>R180</th></tr>
<tr><td>30</td><td>0,6</td><td>0,3</td><td rowspan="2">-</td><td rowspan="5">-</td><td rowspan="9">-</td></tr>
<tr><td>35</td><td>0,7</td><td>0,3</td></tr>
<tr><td>40</td><td>0,9</td><td>0,4</td><td>0,2</td></tr>
<tr><td>45</td><td>1,0</td><td>0,4</td><td>0,2</td></tr>
<tr><td>50</td><td>1,2</td><td>0,5</td><td>0,3</td></tr>
<tr><td>55</td><td>1,5</td><td>0,6</td><td>0,3</td><td>0,2</td></tr>
<tr><td>60</td><td>1,8</td><td>0,8</td><td>0,4</td><td>0,3</td></tr>
<tr><td>65</td><td rowspan="16">2,2</td><td>0,9</td><td>0,5</td><td>0,3</td></tr>
<tr><td>70</td><td>1,0</td><td>0,5</td><td>0,3</td></tr>
<tr><td>75</td><td>1,2</td><td>0,6</td><td>0,4</td><td>0,2</td></tr>
<tr><td>80</td><td>1,5</td><td>0,7</td><td>0,5</td><td>0,3</td></tr>
<tr><td>85</td><td>1,7</td><td>0,8</td><td>0,5</td><td>0,3</td></tr>
<tr><td>90</td><td>2,0</td><td>1,0</td><td>0,6</td><td>0,3</td></tr>
<tr><td>95</td><td rowspan="10">2,2</td><td>1,1</td><td>0,7</td><td>0,4</td></tr>
<tr><td>100</td><td>1,3</td><td>0,8</td><td>0,4</td></tr>
<tr><td>105</td><td>1,5</td><td>0,9</td><td>0,5</td></tr>
<tr><td>110</td><td>1,7</td><td>1,1</td><td>0,5</td></tr>
<tr><td>115</td><td>2,0</td><td>1,2</td><td>0,6</td></tr>
<tr><td>120</td><td rowspan="5">2,2</td><td>1,4</td><td>0,6</td></tr>
<tr><td>125</td><td>1,6</td><td>0,7</td></tr>
<tr><td>130</td><td>1,9</td><td>0,8</td></tr>
<tr><td>135</td><td rowspan="2">2,1</td><td>0,9</td></tr>
<tr><td>200</td><td>2,3</td></tr>
</table>

Materials

Material quality

Part	Material
Rebar EN 1992-1-1	Bars and de-coiled rods class B or C with f_{yk} and k according to NDP or NCL of EN 1992-1-1 $f_{uk} = f_{tk} = k \cdot f_{yk}$

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 environment at 50 °C during 90 days**.
These tests show an excellent behaviour of the post-installed connection made with HIT-HY 200: low displacements with long term stability, failure load after exposure above reference load.

Resistance to chemical substances

Chemical	Resistance	Chemical	Resistance
Air	+	Gasoline	+
Acetic acid 10%	+	Glycole	o
Acetone	o	Hydrogen peroxide 10%	o
Ammonia 5%	+	Lactic acid 10%	+
Benzyl alcohol	-	Maschinery oil	+
Chloric acid 10%	o	Methylethylketon	o
Chlorinated lime 10%	+	Nitric acid 10%	o
Citric acid 10%	+	Phosphoric acid 10%	+
Concrete plasticizer	+	Potassium Hydroxide pH 13,2	+
De-icing salt (Calcium chloride)	+	Sea water	+
Demineralized water	+	Sewage sludge	+
Diesel fuel	+	Sodium carbonate 10%	+
Drilling dust suspension pH 13,2	+	Sodium hypochlorite 2%	+
Ethanol 96%	-	Sulfuric acid 10%	+
Ethylacetate	-	Sulfuric acid 30%	+
Formic acid 10%	+	Toluene	o
Formwork oil	+	Xylene	o

+ resistant
o resistant in short term (max. 48h) contact
- not resistant

Electrical Conductivity

HIT-HY 200 in the hardened state **is not conductive electrically**. Its electric resistivity is $15{,}5 \cdot 10^9\ \Omega \cdot cm$ (DIN IEC 93 – 12.93). It is adapted well to realize electrically insulating anchoring (ex: railway applications, subway)

Setting information

Installation temperature range
-10°C to +40°C

Service temperature range
Hilti HIT-HY 200 injection mortar may be applied in the temperature ranges given below. An elevated base material temperature may lead to a reduction of the design bond resistance.

Temperature range	Base material temperature	Maximum long term base material temperature	Maximum short term base material temperature
Temperature range I	-40 °C to +80 °C	+50 °C	+80 °C

Max short term base material temperature
Short-term elevated base material temperatures are those that occur over brief intervals, e.g. as a result of diurnal cycling.
Max long term base material temperature
Long-term elevated base material temperatures are roughly constant over significant periods of time.

Curing and working time

Temperature of the base material	HIT-HY 200-A		HIT-HY 200-R	
	Maximum working time t_{work}	Minimum curing time t_{cure}	Maximum working time t_{work}	minimum curing time t_{cure}
- 10°C < T_{BM} ≤ - 5°C	1,5 h	7 h	3 h	20 h
- 5°C < T_{BM} ≤ 0°C	50 min	4 h	2 h	8 h
0°C < T_{BM} ≤ 5°C	25 min	2 hour	1 h	4 h
5°C < T_{BM} ≤ 10°C	15 min	75 min	40 min	2,5 h
10°C < T_{BM} ≤ 20°C	7 min	45 min	15 min	1,5 h
20°C < T_{BM} ≤ 30°C	4 min	30 min	9 min	1 h
30°C < T_{BM} ≤ 40°C	3 min	30 min	6 min	1 h

Setting information

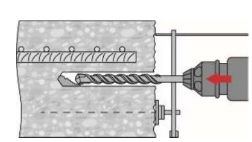
Installation equipment

Rebar – size	ϕ8 - ϕ16	ϕ18 - ϕ32
Rotary hammer	TE 2 (-A)– TE 40(-A)	TE40 – TE80
Other tools	Blow out pump (h_{ef} ≤ 10·d)	-
	Compressed air gun[a)] Set of cleaning brushes[b)], dispenser, piston plug	

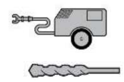
a) Compressed air gun with extension hose for all drill holes deeper than 250 mm (for ϕ 8 to ϕ 12) or deeper than 20·ϕ (for ϕ > 12 mm)
b) Automatic brushing with round brush for all drill holes deeper than 250 mm (for ϕ 8 to ϕ 12) or deeper than 20·ϕ (for ϕ > 12 mm)

Minimum concrete cover c_{min} of the post-installed rebar

Drilling method	Bar diameter [mm]	Minimum concrete cover c_{min} [mm]	
		Without drilling aid	With drilling aid
Hammer drilling **(HD) and (HDB)**	ϕ < 25	30 + 0,06 · l_v ≥ 2 · ϕ	30 + 0,02 · l_v ≥ 2 · ϕ
	ϕ ≥ 25	40 + 0,06 · l_v ≥ 2 · ϕ	40 + 0,02 · l_v ≥ 2 · ϕ
Compressed air drilling **(CA)**	ϕ < 25	50 + 0,08 · l_v	50 + 0,02 · l_v
	ϕ ≥ 25	60 + 0,08 · l_v ≥ 2 · ϕ	60 + 0,02 · l_v ≥ 2 · ϕ



Drilling and cleaning diameters

Rebar [mm]	Hammer drill (HD)	Hollow Drill Bit (HDB) [b]	Compressed air drill (CA)	Brush HIT-RB	Air nozzle HIT-RB
	d₀ [mm]			size [mm]	
					
ϕ8	12 / 10 [a]	12	-	12 / 10 [a]	12 / 10 [a]
ϕ10	14 / 12 [a]	14 / 12 [a]	-	14 / 12 [a]	14 / 12 [a]
ϕ12	16 / 14 [a]	16 / 14 [a]	-	16 / 14 [a]	16 / 14 [a]
	-	-	17	18	16
ϕ14	18	18	17	18	18
ϕ16	20	20	-	20	20
	-	-	20	22	20
ϕ18	22	22	22	22	22
ϕ20	25	25	-	25	25
	-	-	26	28	25
ϕ22	28	28	28	28	28
ϕ24	32	32	32	32	32
ϕ25	32	32	32	32	
ϕ26	35	-	35	35	
ϕ28	35	-	35	35	
ϕ30	-	-	35	35	
	37	-	-	37	
ϕ32	40	-	40	40	

a) Maximum installation length l=250 mm.
b) No cleaning required

Dispensers and corresponding maximum embedment depth $\ell_{v,max}$

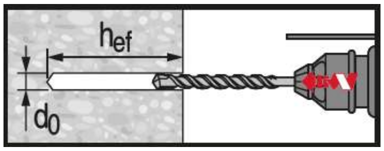
Rebar	Dispenser	
	HDM 330, HDM 500, HDE 500	HDE 500
	Concrete temp. ≥ -10°C	Concrete temp. ≥ 0°C
	$\ell_{v,max}$ [mm]	$\ell_{v,max}$ [mm]
ϕ8 - ϕ32	700	1000

Setting instructions

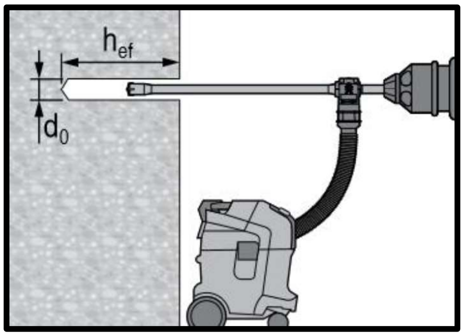
***For detailed information on installation see instruction for use given with the package of the product.**

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-HY 200.

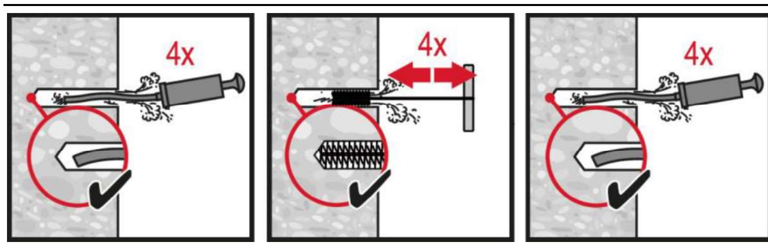


Hammer drilled hole (HD)

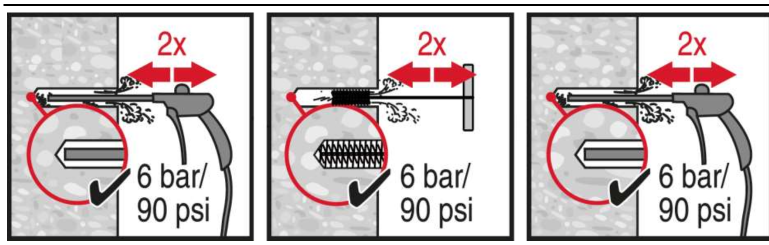


Hammer drilled hole with Hollow Drilled Bit (HDB)

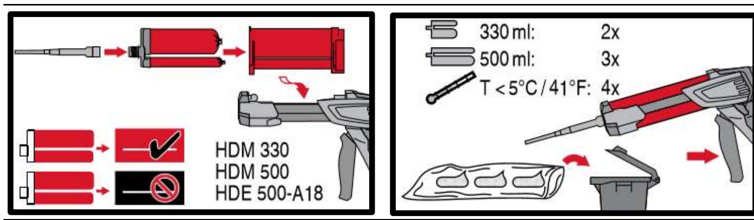
No cleaning required



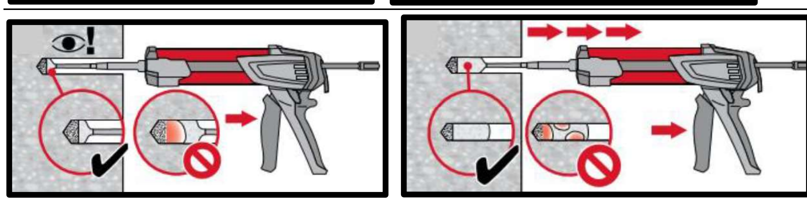
Manual cleaning (MC)
for drill diameters $d_0 \leq 20$ mm and drill hole depth $h_0 \leq 10 \cdot d$.



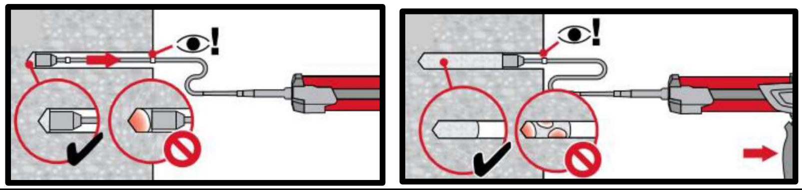
Compressed air cleaning (CAC)
for all drill hole diameters d_0 and drill hole depths $h_0 \leq 20 \cdot d$.



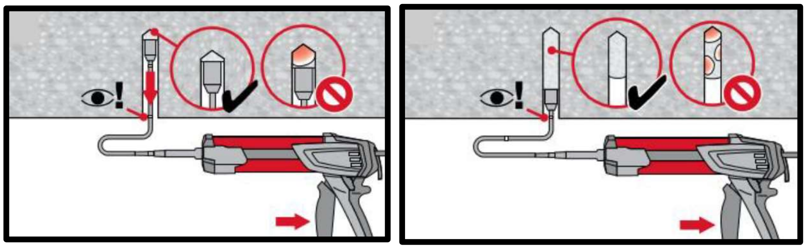
Injection system preparation.



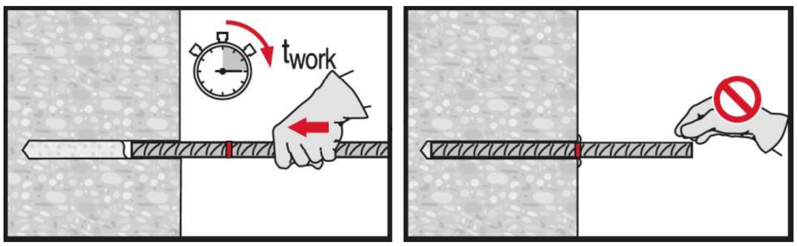
Injection method for drill hole depth $h_{ef} \leq 250$ mm.



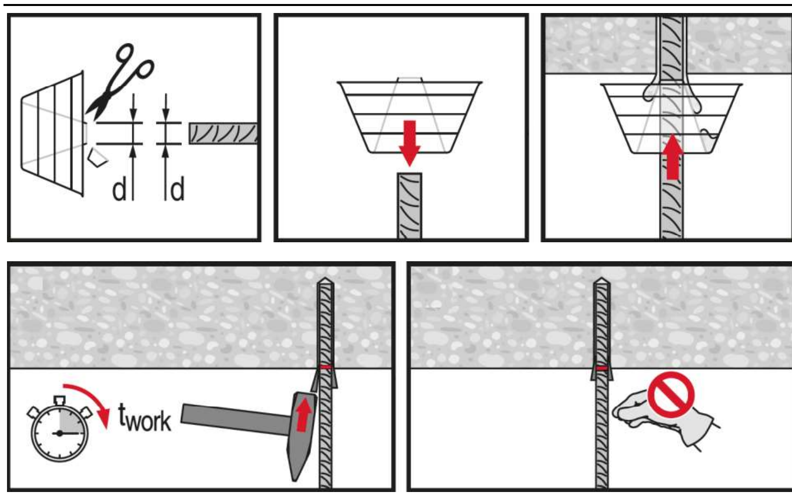
Injection method for drill hole depth h_{ef} > 250mm.



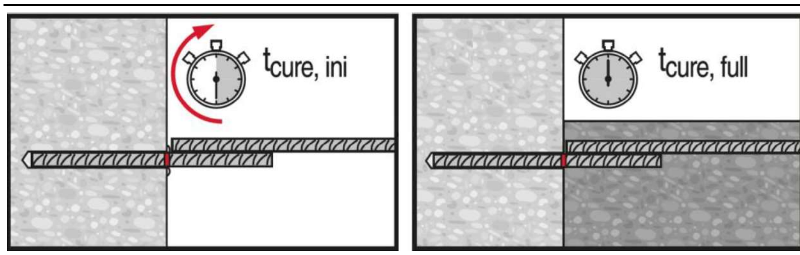
Injection method for overhead application.



Setting element, observe working time “t_{work}”.



Setting element for overhead applications, observe working time “t_{work}”.



Apply full load only after curing time “t_{cure}“.