Hilti HIT-RE 500 V3 mortar with HIT-V rod

Injection mortar system

Hilti
HIT-RE 500 V3
330 ml, 500 ml and
1400 ml foil pack

Statik mixer

HIT-V rod

Benefits

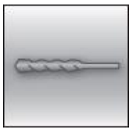
- **SAFEset** technology: hammer drilling and borehole cleaning in one step with Hilti hollow drill bit
- **SAFEset** technology: highest reliability in diamond coring with Hilti Roughening tool
- suitable for cracked/non-cracked concrete C 20/25 to C 50/60
- high loading capacity
- suitable for dry and water saturated concrete
- under water application
- fastest curing epoxy mortar to speed up construction process
- long working time to allow installation of big diameters and/or deep embedment depths even at higher temperatures
- cures down to -5°C
- odourless epoxy

Base material

Concrete (non-cracked)

Concrete (cracked)

Installation conditions

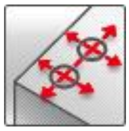


Hammer drilled holes

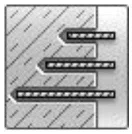
Diamond drilled holes

SAFEset

Hilti SAFEset technology

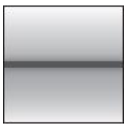


Small edge distance and spacing



Variable embedment depth

Load conditions



Static/ quasi-static

Seismic ETA-C1

Other information

European Technical Assessment

CE conformity

PROFIS Anchor design Software

A4 316

Corrosion resistance

HCR highMo

High corrosion resistance

Approvals / certificates

Description	Authority / Laboratory	No. / date of issue
European Technical Assessment	CSTB	ETA-16/0143 / 2016-04-18

Basic loading data (for a single anchor)

Static and quasi-static resistance

All data in this section applies to
- Correct setting (See setting instruction)
- No edge distance and spacing influence
- *Steel* failure
- Anchor HIT-V with strength class 5.8
- Base material thickness, as specified in the table
- One typical embedment depth, as specified in the table
- Concrete C 20/25, $f_{ck,cube}$ = 25 N/mm²
- Temperate range I
  (min. base material temperature -40°C, max. long term/short term base material temperature: +24°C/40°C)
- Installation temperature range -5°C to +40°C

Embedment depth[a)] and base material thickness

Anchor size		M8	M10	M12	M16	M20	M24	M27	M30	M33	M36	M39
Typical embedment depth	[mm]	80	90	110	125	170	210	240	270	300	330	360
Base material thickness	[mm]	110	120	140	165	220	270	300	340	380	410	450

a) The allowed range of embedment depth is shown in the setting details.

For hammer drilled holes and hollow drill bit and diamond drilling with roughening[1)]:

Mean ultimate resistance

			ETA-16/0143, issue 2016-04-18								Additional Hilti technical data		
Anchor size			**M8**	**M10**	**M12**	**M16**	**M20**	**M24**	**M27**	**M30**	**M33**	**M36**	**M39**
Non cracked concrete													
Tensile $N_{Ru,m}$	HIT-V	[kN]	*19,2*	*30,5*	*44,3*	*82,4*	*128,6*	*185,3*	*241,0*	*294,5*	*348,4*	*401,9*	*457,9*
Shear $V_{Ru,m}$	HIT-V	[kN]	*9,6*	*15,2*	*22,1*	*41,2*	*64,3*	*92,7*	*120,5*	*147,3*	*182,2*	*214,5*	*256,2*
Cracked concrete													
Tensile $N_{Ru,m}$	HIT-V	[kN]	13,7	22,3	34,8	52,8	89,7	133,0	171,0	212,0	-	-	-
Shear $V_{Ru,m}$	HIT-V	[kN]	*9,6*	*15,2*	*22,1*	*41,2*	*64,3*	*92,7*	*120,5*	*147,3*	-	-	-

1) Roughening tools are available for element sizes M16 – M30.

Characteristic resistance

			ETA-16/0143, issue 2016-04-18								Additional Hilti technical data		
Anchor size			**M8**	**M10**	**M12**	**M16**	**M20**	**M24**	**M27**	**M30**	**M33**	**M36**	**M39**
Non cracked concrete													
Tensile N_{Rk}	HIT-V	[kN]	*18,3*	*29,0*	*42,2*	70,6	111,9	153,7	187,8	224,0	262,4	302,7	344,9
Shear V_{Rk}	HIT-V	[kN]	*9,2*	*14,5*	*21,1*	*39,3*	*61,3*	*88,3*	*114,8*	*140,3*	*173,5*	*204,3*	*244,0*
Cracked concrete													
Tensile N_{Rk}	HIT-V	[kN]	13,1	21,2	33,2	50,3	79,8	109,6	133,9	159,7	-	-	-
Shear V_{Rk}	HIT-V	[kN]	*9,2*	*14,5*	*21,1*	*39,3*	*61,3*	*88,3*	*114,8*	*140,3*	-	-	-

Design resistance

			ETA-16/0143, issue 2016-04-18								Additional Hilti technical data		
Anchor size			**M8**	**M10**	**M12**	**M16**	**M20**	**M24**	**M27**	**M30**	**M33**	**M36**	**M39**
Non cracked concrete													
Tensile N_{Rd}	HIT-V	[kN]	*12,2*	*19,3*	*28,1*	47,1	74,6	102,5	125,2	149,4	145,8	168,2	191,6
Shear V_{Rd}	HIT-V	[kN]	*7,3*	*11,6*	*16,9*	*31,4*	*49,0*	*70,6*	*91,8*	*112,2*	138,8	163,4	195,2
Cracked concrete													
Tensile N_{Rd}	HIT-V	[kN]	8,7	14,1	22,1	33,5	53,2	73,0	89,2	106,5	-	-	-
Shear V_{Rd}	HIT-V	[kN]	*7,3*	*11,6*	*16,9*	*31,4*	*49,0*	*70,6*	*91,8*	*112,2*	-	-	-

Recommended loads [a)]

			ETA-16/0143, issue 2016-04-18								Additional Hilti technical data		
Anchor size			**M8**	**M10**	**M12**	**M16**	**M20**	**M24**	**M27**	**M30**	**M33**	**M36**	**M39**
Non cracked concrete													
Tensile N_{rec}	HIT-V	[kN]	8,7	13,8	20,1	33,6	53,3	73,2	89,4	106,7	104,1	120,1	136,9
Shear V_{rec}	HIT-V	[kN]	5,2	8,3	12,0	22,4	35,0	50,4	65,6	80,1	99,1	116,7	139,4
Cracked concrete													
Tensile N_{Rec}	HIT-V	[kN]	6,2	10,1	15,8	23,9	38,0	52,2	63,7	76,1	-	-	-
Shear V_{Rec}	HIT-V	[kN]	5,2	8,3	12,0	22,4	35,0	50,4	65,6	80,1	-	-	-

a) With overall partial safety factor for action γ = 1,4. The partial safety factors for action depend on the type of loading and shall be taken from national regulations.

For diamond drilling:

Mean ultimate resistance

Anchor size			**M8**	**M10**	**M12**	**M16**	**M20**	**M24**	**M27**	**M30**
Non cracked concrete										
Tensile $N_{Ru,m}$	HIT-V	[kN]	*19,2*	*30,5*	*44,3*	*82,4*	*128,6*	*185,3*	*241,0*	*294,5*
Shear $V_{Ru,m}$	HIT-V	[kN]	*9,6*	*15,2*	*22,1*	*41,2*	*64,3*	*92,7*	*120,5*	*147,3*

Characteristic resistance

Anchor size			**M8**	**M10**	**M12**	**M16**	**M20**	**M24**	**M27**	**M30**
Non cracked concrete										
Tensile N_{Rk}	HIT-V	[kN]	*18,3*	*29,0*	*42,2*	70,6	111,9	153,7	187,8	224,0
Shear V_{Rk}	HIT-V	[kN]	*9,2*	*14,5*	*21,1*	*39,3*	*61,3*	*88,3*	*114,8*	*140,3*

Design resistance

Anchor size			**M8**	**M10**	**M12**	**M16**	**M20**	**M24**	**M27**	**M30**
Non cracked concrete										
Tensile N_{Rd}	HIT-V	[kN]	*12,2*	18,8	27,6	33,6	53,3	73,2	89,4	106,7
Shear V_{Rd}	HIT-V	[kN]	*7,3*	*11,6*	*16,9*	*31,4*	*49,0*	*70,6*	*91,8*	*112,2*

Recommended loads [a)]

Anchor size			M8	M10	M12	M16	M20	M24	M27	M30
Non cracked concrete										
Tensile N_{rec}	HIT-V	[kN]	8,7	13,5	19,7	24,0	38,1	52,3	63,9	76,2
Shear V_{rec}	HIT-V	[kN]	5,2	8,3	12,0	22,4	35,0	50,4	65,6	80,1

a) With overall partial safety factor for action γ = 1,4. The partial safety factors for action depend on the type of loading and shall be taken from national regulations.

Seismic resistance C1

All data in this section applies to:

- Correct setting (See setting instruction)
- No edge distance and spacing influence
- *Steel* failure
- Anchor HIT-V with strength class 5.8
- Base material thickness, as specified in the table
- One typical embedment depth, as specified in the table
- Concrete C 20/25, $f_{ck,cube}$ = 25 N/mm²
  Temperate range I
  (min. base material temperature -40°C, max. long/short term base material temperature: +24°C/40°C)
- Installation temperature range -5°C to +40°C
- α_{gap} = 1,0 (no hole clearance between anchor and fixture); in case of connections with hole clearance, α_{gap} = 0,5 has to be used

Embedment depth[a)] and base material thickness

Anchor size		M8	M10	M12	M16	M20	M24	M27	M30	M33	M36	M39
Typical embedment depth	[mm]	80	90	110	125	170	210	240	270	300	330	360
Base material thickness	[mm]	110	120	140	165	220	270	300	340	380	410	450

b) The allowed range of embedment depth is shown in the setting details.

For hammer drilled holes and hollow drill bit:

Characteristic resistance

Anchor size			M8	M10	M12	M16	M20	M24	M27	M30
Cracked concrete										
Tensile N_{Rk}	HIT-V	[kN]	12,1	19,8	32,8	42,8	67,8	93,1	113,8	135,8
Shear V_{Rk}	HIT-V	[kN]	18,3	29,0	42,2	72,7	115,3	158,3	193,4	230,8

Design resistance

Anchor size			M8	M10	M12	M16	M20	M24	M27	M30
Cracked concrete										
Tensile N_{Rd}	HIT-V	[kN]	8,0	13,2	21,8	28,5	45,2	62,1	75,9	90,5
Shear V_{Rd}	HIT-V	[kN]	13,7	22,4	33,7	48,5	76,9	105,5	128,9	153,9

Service temperature range

Hilti HIT-RE 500 V3 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 +40 °C	+24 °C	+40 °C
Temperature range II	-40 °C to +70 °C	+43 °C	+70 °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.

Materials

Mechanical properties

			Data according to ETA-16/0143, issue 2016-04-18								Additional Hilti Technical data		
Anchor size			**M8**	**M10**	**M12**	**M16**	**M20**	**M24**	**M27**	**M30**	**M33**	**M36**	**M39**
Nominal tensile strength f_{uk}	HIT-V 5.8	[N/mm²]	500	500	500	500	500	500	500	500	500	500	500
	HIT-V 8.8	[N/mm²]	800	800	800	800	800	800	800	800	800	800	800
	HIT-V-R	[N/mm²]	700	700	700	700	700	700	500	500	500	500	500
	HIT-V-HCR	[N/mm²]	800	800	800	800	800	700	700	700	500	500	500
Yield strength f_{yk}	HIT-V 5.8	[N/mm²]	400	400	400	400	400	400	400	400	400	400	400
	HIT-V 8.8	[N/mm²]	640	640	640	640	640	640	640	640	640	640	640
	HIT-V-R	[N/mm²]	450	450	450	450	450	450	210	210	210	210	210
	HIT-V-HCR	[N/mm²]	640	640	640	640	640	400	400	400	250	250	250
Stressed cross-section A_s	HIT-V	[mm²]	36,6	58,0	84,3	157	245	353	459	561	694	817	976
Moment of resistance W	HIT-V	[mm³]	31,2	62,3	109	277	541	935	1387	1874	2579	3294	4301

Material quality

Part	Material
Threaded rod HIT-V 5.8	Strength class 5.8, A5 > 8% ductile Electroplated zinc coated ≥ 5µm Hot dip galvanized ≥ 45 µm
Threaded rod HIT-V 8.8	Strength class 8.8, A5 > 12% ductile Electroplated zinc coated ≥ 5µm Hot dip galvanized ≥ 45 µm
Threaded rod HIT-V-R	Strength class 70 for ≤ M24 and class 50 for > M24, A5 > 8% ductile Stainless steel 1.4401; 1.4404; 1.4578; 1.4571; 1.4439; 1.4362
Threaded rod HIT-V-HCR	Strength class 70 for ≤ M24 and class 50 for > M24, A5 > 8% ductile High corrosion resistant steel 1.4528, 1.4565
Washer	Electroplatedzinc coated ≥ 5 µm, hot dip galvanized ≥ 45 µm
	Stainless steel 1.4401, 1.4404, 1.4578, 1.4571, 1.4439, 1.4362 EN 10088-1:2014
	High corrosion resistant steel 1.4529, 1.4565 EN 10088-1:2014
Nut	Strength class of nut adapted to strength class of threaded rod. Electroplated zinc coated ≥ 5µm, hot dip galvanized ≥ 45 µm
	Strength class of nut adapted to strength class of threaded rod. Stainless steel 1.4401, 1.4404, 1.4578, 1.4571, 1.4439, 1.4362 EN 10088-1:2014
	Strength class of nut adapted to strength class of threaded rod. High corrosion resistant steel 1.4529, 1.4565 EN 10088-1:2014

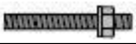
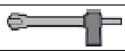
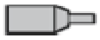
Setting

Installation equipment

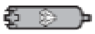
Anchor size	M8	M10	M12	M16	M20	M24	M27	M30
Rotary hammer	TE 2 – TE 16				TE 40 – TE 70			
Other tools	compressed air gun, set of cleaning brushes, dispenser, roughening tools TE-YRT							
Additional Hilti recommended tools	DD EC-1, DD 100 … DD xxx [a)]							

a) For anchors in diamond drilled holes load values for combined pull-out and concrete cone resistance have to be reduced (see section “Setting instruction”)

Parameters of cleaning and setting tools

Element	Drill and clean				Installation	
Threaded rod, HIT-V-…	Hammer drilling	Hollow drill bit TE-CD, TE-YD	Diamond coring	Diamond coring with roughening tool TE-YRT	Brush	Piston plug
						
Size	d_0 [mm]	d_0 [mm]	d_0 [mm]	d_0 [mm]	HIT-RB	HIT-SZ
M8	10	-	10	-	10	-
M10	12	-	12	-	12	12
M12	14	14	14	-	14	14
M16	18	18	18	18	18	18
M20	22	22	22	22	22	22
M24	28	28	28	28	28	28
M27	30	-	30	30	30	30
M30	35	35	35	35	35	35

Associated components for the use of Hilti Roughening tool TE-YRT

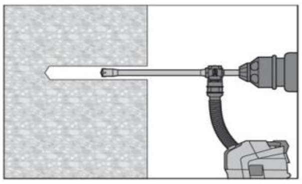
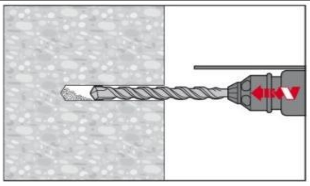
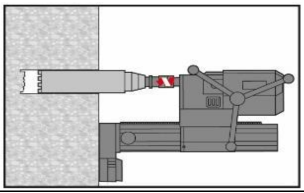
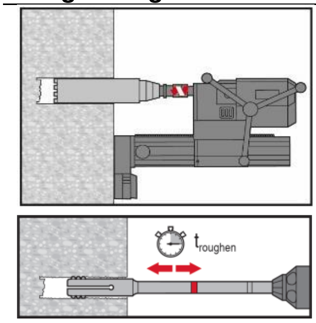
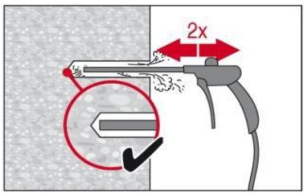
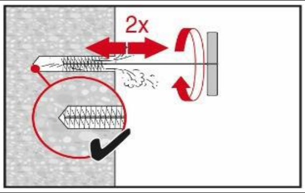
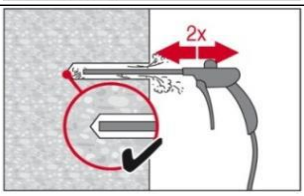
Diamond coring		Roughening tool TE-YRT	Wear gauge RTG…
			
d_0 [mm]		d_0 [mm]	size
Nominal	measured		
18	17,9 to 18,2	18	18
20	19,9 to 20,2	20	20
22	21,9 to 22,2	22	22
25	24,9 to 25,2	25	25
28	27,9 to 28,2	28	28
30	29,9 to 30,2	30	30
32	31,9 to 32,2	32	32
35	34,9 to 35,2	35	35

Minimum roughening time $t_{roughen}$ ($t_{roughen}$ [sec] = h_{ef} [mm] / 10)

h_{ef} [mm]	$t_{roughen}$ [sec]
0 to 100	10
101 to 200	20
201 to 300	30
301 to 400	40
401 to 500	50
501 to 600	60

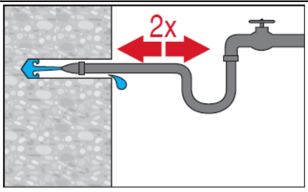
Setting instructions

Bore hole drilling

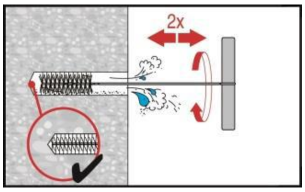
a) Hilti hollow drill bit	For dry and wet concrete only.
	Drill hole to the required embedment depth with an appropriately sized Hilti TE-CD or TE-YD hollow drill bit with Hilti vacuum attachment. This drilling system removes the dust and cleans the bore hole during drilling when used in accordance with the user’s manual. After drilling is complete, proceed to the “injection preparation” step in the instructions for use.
b) Hammer drilling	Dry or wet concrete and installation in flooded holes (no sea water).
	Drill Hole to the required embedment depth with a hammer drill set in rotation-hammer mode using an appropriately sized carbide drill bit.
c) Diamond coring	For dry and wet concrete only.
	Diamond coring is permissible when diamond core drilling machine and the corresponding core bit are used.
d) Diamond coring followed by roughening with Hilti rough. tool	For dry and wet concrete only.
	Diamond coring is permissible when suitable diamond core drilling machines and the corresponding core bits are used. Before roughening the borehole needs to be dry. Check usability of the roughening tool with the wear gauge RTG. Roughen the borehole over the whole length to the required hef.
Bore hole cleaning	Just before setting an anchor, the bore hole must be free of dust and debris. Inadequate hole cleaning = poor load values.
a) Compressed air cleaning (CAC)	For all drill hole diameters d_0 and all drill hole depths h_0.
	Blow 2 times from the back of the hole (if needed with nozzle extension) over the whole length with oil-free compressed air (min. 6 bar at 6 m³/h) until return air stream is free of noticeable dust. For drill hole diameters ≥ 32 mm the compressor has to supply a minimum air flow of 140 m³/h.
	Brush 2 times with the specified brush by inserting the steel brush Hilti HIT-RB to the back of the hole (if needed with extension) in a twisting motion and removing it. The brush must produce natural resistance as it enters the drill hole (brush Ø ≥ drill hole Ø) - if not the brush is too small and must be replaced with the proper brush diameter.
	Blow again with compressed air 2 times until return air stream is free of noticeable dust.

b) Cleaning of hammer drilled flooded holes and diamond cored holes

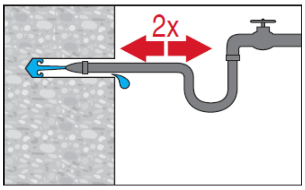
For all bore hole diameters d_0 and all bore hole depth h_0



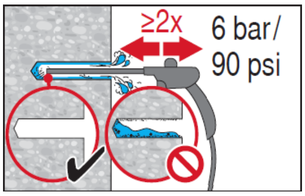
Flush 2 times the hole by inserting a water hose (water-line pressure) to the back of the hole until water runs clear.



Brush 2 times with the specified brush size by inserting the steel brush Hilti HIT-RB to the back of the hole (if needed with extension) in a twisting motion and removing it.
The brush must produce natural resistance as it enters the bore hole - if not the brush is too small and must be replaced with the proper brush diameter.

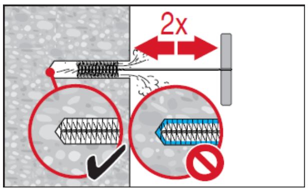


Flush again 2 times the hole by inserting a water hose (water-line pressure) to the back of the hole until water runs clear.

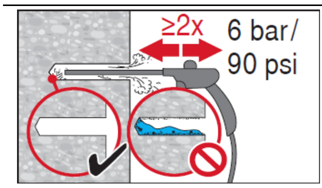


Blow 2 times from the back of the hole (if needed with nozzle extension) over the hole length with oil-free compressed air (min. 6 bar at 6 m^3/h) until return air stream is free of noticeable dust and water.

Bore hole diameter ≥ 32 mm the compressor must supply a minimum air flow of 140 m^3/hour.

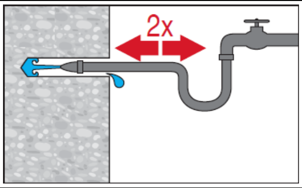


Brush 2 times with the specified brush size by inserting the steel brush Hilti HIT-RB to the back of the hole (if needed with extension) in a twisting motion and removing it.
The brush must produce natural resistance as it enters the bore hole - if not the brush is too small and must be replaced with the proper brush diameter.

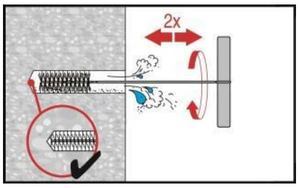


Blow again with compressed air 2 times until return air stream is free of noticeable dust and water.

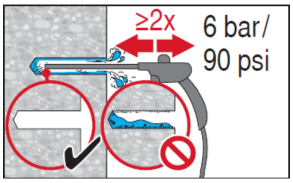
c) Cleaning of diamond cored holes followed by roughening For all drill hole diameters d_0 and all drill hole depths h_0.



Flush 2 times by inserting a water hose (water-line pressure) to the back of the hole until water runs clear.

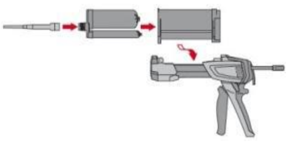


Brush 2 times with the specified brush by inserting the steel brush Hilti HIT-RB to the back of the hole (if needed with extension) in a twisting motion and removing it. The brush must produce natural resistance as it enters the drill hole (brush Ø ≥ drill hole Ø) - if not the brush is too small and must be replaced with the proper brush diameter.

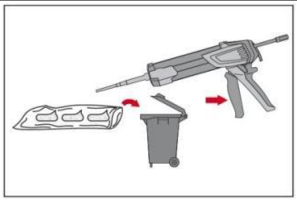


Blow 2 times from the back of the hole (if needed with nozzle extension) over the whole length with oil-free compressed air (min. 6 bar at 6 m³/h) until return air stream is free of noticeable dust and water. For drill hole diameters ≥ 32 mm the compressor has to supply a minimum air flow of 140 m³/h.

Injection preparation

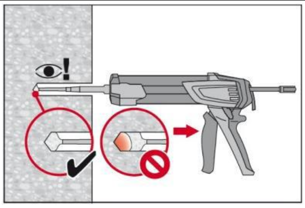


Tightly attach new Hilti mixing nozzle HIT-RE-M to foil pack manifold (snug fit). Do not modify the mixing nozzle. Observe the instruction for use of the dispenser and mortar.
Check foil pack holder for proper function. Do not use damaged foil packs / holders.
Insert foil pack into foil pack holder and put holder into HIT-dispenser.

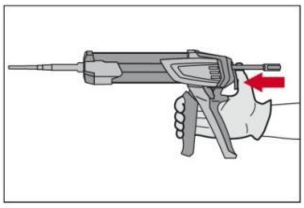


The foil pack opens automatically as dispensing is initiated. Discard initial adhesive. Depending on the size of the foil pack an initial amount of adhesive has to be discarded.
Discard quantities are: 3 strokes for 330 ml foil pack, 4 strokes for 500 ml foil pack, 65 ml for 1400 ml foil pack.

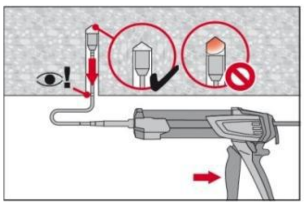
Inject adhesive From the back of the drill hole without forming air voids



Inject the adhesive starting at the back of the hole, slowly withdrawing the mixer with each trigger pull.
Fill holes approximately 2/3 full. It is required that the annular gap between the anchor and the concrete is completely filled with adhesive along the embedment length.



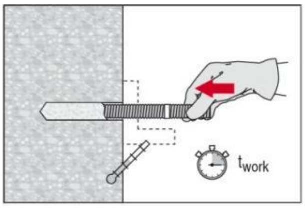
After injection is completed, depressurize the dispenser by pressing the release trigger. This will prevent further adhesive discharge from the mixer.



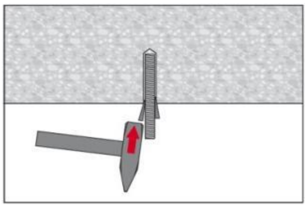
Overhead installation and/or installation with embedment depth h_{ef} > 250mm.
For overhead installation the injection is only possible with the aid of extensions and piston plugs. Assemble HIT-RE-M mixer, extension(s) and appropriately sized piston plug HIT-SZ. Insert piston plug to back of the hole and inject adhesive. During injection the piston plug will be naturally extruded out of the bore hole by the adhesive pressure.

Setting the element

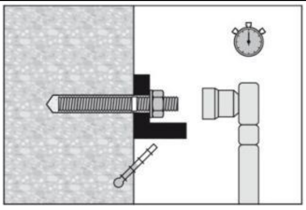
Just before setting an anchor, the drill hole must be free of dust and debris.



Before use, verify that the element is dry and free of oil and other contaminants.
Mark and set element to the required embedment depth untill working time t_{work} has elapsed.



For overhead installation use piston plugs and fix embedded parts with e.g. wedges HIT-OHW.



Loading the anchor: after required curing time t_{cure} the anchor can be loaded.
The applied installation torque shall not exceed $T_{max.}$

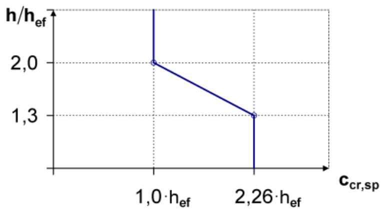
For detailed information on installation see instruction for use given with the package of the product.

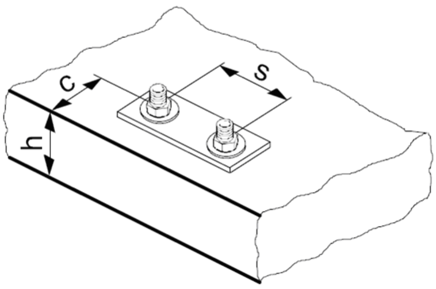
Curing time for general conditions

Temperature of the base material T	Working time t_{work}	Minimum curing time t_{cure} 1)
-5 °C to -1 °C	2 h	168 h
0 °C to 4 °C	2 h	48 h
5 °C to 9 °C	2 h	24 h
10 °C to 14 °C	1,5 h	16 h
15 °C to 19 °C	1 h	16 h
20 °C to 24 °C	30 min	7 h
25 °C to 29 °C	20 min	6 h
30 °C to 34 °C	15 min	5 h
35 °C to 39 °C	12 min	4,5 h
40 °C	10 min	4 h

1) The curing time data are valid for dry base material only. In wet base material the curing times must be doubled.

Setting details

			Data according to ETA-16/0143, issue 2016-04-18								Additional Hilti Technical data		
Anchor size			**M8**	**M10**	**M12**	**M16**	**M20**	**M24**	**M27**	**M30**	**M33**	**M36**	**M39**
Nominal diameter of drill bit	d_0	[mm]	10	12	14	18	22	28	30	35	37	40	42
Effective anchorage and drill hole depth range [a)]	$h_{ef,min}$	[mm]	60	60	70	80	90	96	108	120	132	144	156
	$h_{ef,max}$	[mm]	160	200	240	320	400	480	540	600	660	720	780
Maximum diameter of clearance hole in the fixture	d_f	[mm]	9	12	14	18	22	26	30	33	36	39	42
Minimum base material thickness	h_{min}	[mm]	h_{ef} +30 mm ≥ 100 mm		$h_{ef} + 2\ d_0$								
Maximum torque moment	T_{max}	[mm]	10	20	40	80	150	200	270	300	330	360	390
Minimum spacing	s_{min}	[mm]	40	50	60	75	90	115	120	140	165	180	195
Minimum edge distance	c_{min}	[mm]	40	45	45	50	55	60	75	80	165	180	195
Critical spacing for splitting failure	$s_{cr,sp}$		$2\ c_{cr,sp}$										
Critical edge distance for splitting failure [b)]	$c_{cr,sp}$	[mm]	**$1{,}0 \cdot h_{ef}$** for $h / h_{ef} \geq 2{,}0$ **$4{,}6\ h_{ef} - 1{,}8\ h$** for $2{,}0 > h / h_{ef} > 1{,}3$ **$2{,}26\ h_{ef}$** for $h / h_{ef} \leq 1{,}3$										
Critical spacing for concrete cone failure	$s_{cr,N}$		$2\ c_{cr,N}$										
Critical edge distance for concrete cone failure [c)]	$c_{cr,N}$		$1{,}5\ h_{ef}$										



For spacing (edge distance) smaller than critical spacing (critical edge distance) the design loads have to be reduced.

a) $h_{ef,min} \leq h_{ef} \leq h_{ef,max}$ (h_{ef}: embedment depth)

b) h: base material thickness ($h \geq h_{min}$)

c) The critical edge distance for concrete cone failure depends on the embedment depth h_{ef} and the design bond resistance. The simplified formula given in this table is on the save side.