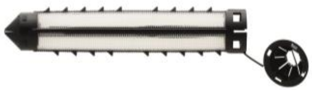
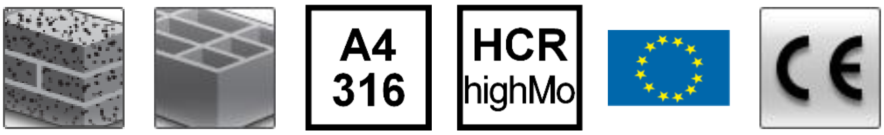
Anchor Fastening Technology Manual

Hilti HIT-HY 170 Injection mortar

Version 2015-05

Hilti HIT-HY 170 mortar for masonry

Injection mortar system	Benefits
 Hilti HIT-HY 170 500 ml foil pack (also available as 330 ml foil pack)  Mixer  HIT-V rod  HIT-IC internally threaded sleeve  HIT-SC composite sleeve	- chemical injection fastening for the most common types of base materials: - hollow and solid clay and calcium silicate bricks - two-component hybrid mortar - versatile and convenient handling featuring HDE dispenser - mortar filling control with HIT-SC sleeves - in-service temperatures: short term: max. 80°C long term: max. 50°C



Solid brick | Hollow brick | Corrosion resistance | High corrosion resistance | European Technical Approval | CE conformity

Approvals / certificates

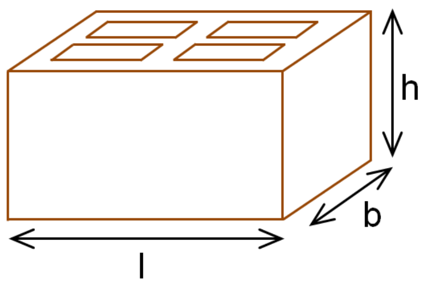
Description	Authority / Laboratory	No. / date of issue
European Technical Assessment	DIBt, Berlin	ETA-15/0197 / 2015-04-28

Brick types and properties

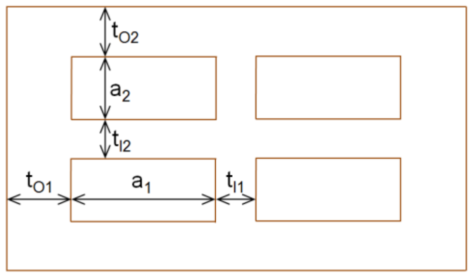
Instruction to this technical data

- Identify/choose your brick (or brick type) and its geometrical/physical properties on the following tables.
- The pages referred on the last column of the table below contain the design resistance loads for pull-out failure of the anchor, brick breakout failure and local brick failure for each respective brick. Notice that the data displayed on these tables is only valid for single anchors with distance to the edge bigger or equal to $c_{cr} = c_{min}$ – for other cases not covered, please contact Hilti Engineering Team.
- The resistance loads provided by this technical data manual are valid only for the exact same masonry unit (hollow bricks) or for units made of the same base material with equal or higher size and compressive strength (solid bricks). For other cases, on-site tests must be performed – please consult page 9.

Exterior brick dimensions



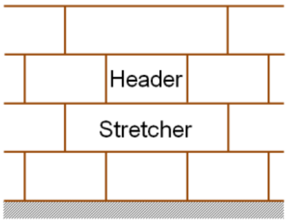
Interior dimensions of the majority of the holes



Brick code	Data	Brick name	Image	Size [mm]	t_O [mm]	t_I [mm]	a [mm]	f_b [N/mm²]	ρ [kg/dm³]	Page
Solid Clay										
SC	ETA	Solid clay brick Mz, 2DF		l: ≥240 b: ≥115 h: ≥113	-	-	-	12	2,0	7
Hollow Clay										
HC	ETA	Hollow clay brick Hlz, 10DF		l: 300 b: 240 h: 238	t_{O1}: 12 t_{O2}: 15	t_{I1}: 11 t_{I2}: 15	a_1: 10 a_2: 25	12/20	1,4	7
Solid Calcium Silicate										
SCS	ETA	Solid silica brick KS, 2DF		l: ≥240 b: ≥115 h: ≥113	-	-	-	12/28	2,0	7
Hollow Calcium Silicate										
HCS	ETA	Hollow silica brick KSL, 8DF		l: 248 b: 240 h: 238	t_{O1}: 34 t_{O2}: 21	t_{I1}: 12 t_{I2}: 30	a_1: 50 a_2: 50	12/20	1,4	7

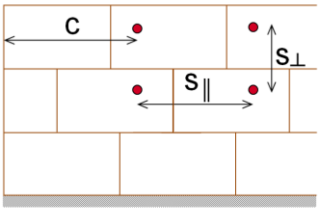
Anchor installation parameters

Brick position:



- **Header (H):** The longest dimension of the brick represents the width of the wall
- **Stretcher (S):** The longest dimension of the brick represents the length of the wall

Spacing and edge distance:

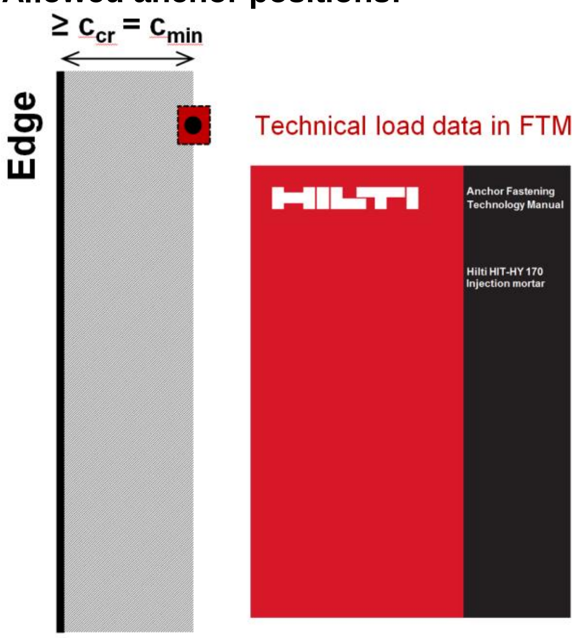


- c - Distance to the edge
- $s_{\parallel}$ - Spacing parallel to the horizontal joint
- $s_{\perp}$ - Spacing perpendicular to the horizontal joint

Minimum and characteristic spacing and edge distance parameters

- c_{min} – Minimum edge distance
- c_{cr} – Characteristic edge distance
- $s_{min\,\parallel}$ - Min. spacing distance parallel to the bed joint
- $s_{cr\,\parallel}$ - Characteristic spacing distance parallel to the bed joint
- $s_{min\,\perp}$ - Min. spacing distance perpendicular to the bed joint
- $s_{cr\,\perp}$ - Characteristic spacing distance perpendicular to the bed joint

Allowed anchor positions:



- This FTM includes the load data for single anchors in masonry with a distance to the edge bigger or equal to the characteristic edge distance.

Anchor dimensions

Anchor size Threaded rod HIT-V, HIT-V-R, HIT-V-HCR	**M8**	**M10**	**M12**
Embedment depth h_{ef} [mm]	80		

Anchor size Internally threaded sleeve HIT-IC	**M8x80**	**M10x80**	**M12x80**
Embedment depth h_{ef} [mm]	80		

Design

- Anchorages are designed under the responsibility of an engineer experienced in anchorages and masonry work.
- Verifiable calculation notes and drawings are prepared taking account of the loads to be anchored. The position of the anchor is indicated on the design drawings (e.g. position of the anchor relative to supports, etc.).
- Anchorages under static or quasi-static loading are designed in accordance with: ETAG 029, Annex C, Design method A.

Basic loading data (for a single anchor)

The load tables provide the design resistance load for a single loaded anchor.

All data in this section applies to

- Edge distance $c \geq c_{cr} = c_{min}$.
- Correct anchor setting (see instruction for use, setting details)

Anchorages subject to:		**Hilti HIT-HY 170 with HIT-V or HIT-IC**	
		in solid bricks	**in hollow bricks**
Hole drilling		hammer mode	rotary mode
Use category: dry or wet structure		Category **d/d** - **Installation and use** in structures subject to **dry**, internal conditions, Category **w/d** - **Installation in** dry or **wet** substrate and **use** in structures subject to **dry**, internal conditions, Category **w/w** - **Installation and use** in structures subject to dry or **wet** environmental conditions.	
Installation direction Masonry		horizontal	
Temperature in the base material at installation		+5° C to +40° C	-5° C to +40° C
In-service temperature	Temperature range Ta:	-40 °C to +40°C	(max. long term temperature +24°C and max. short term temperature +40 °C)
	Temperature range Tb:	-40 °C to +80°C	(max. long term temperature +50°C and max. short term temperature +80 °C)

Tension loading

The design tensile resistance is the lower value of

- Steel resistance: $N_{Rd,s}$
- Pull-out of the anchor: $N_{Rd,p}$
- Brick breakout failure: $N_{Rd,b}$
- Pull out of one brick $N_{Rd,pb}$

Shear loading

The design shear resistance is the lower value of

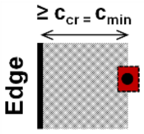
- Steel resistance: $V_{Rd,s}$
- Local brick failure: $V_{Rd,b}$
- Pushing out of one brick: $V_{Rd,pb}$

Design tension and shear resistances – Steel failure for threaded rods HIT-V

Anchor size			M8	M10	M12
$N_{Rd,s}$	HIT-V 5.8(F)	[kN]	12,0	19,3	28,0
	HIT-V 8.8(F)	[kN]	19,3	30,7	44,7
	HIT-V-R	[kN]	13,9	21,9	31,6
	HIT-V-HCR	[kN]	19,3	30,7	44,7
$V_{Rd,s}$	HIT-V 5.8(F)	[kN]	7,2	12,0	16,8
	HIT-V 8.8(F)	[kN]	12,0	18,4	27,2
	HIT-V-R	[kN]	8,3	12,8	19,2
	HIT-V-HCR	[kN]	12,0	18,4	27,2
$M^0_{Rd,s}$	HIT-V 5.8(F)	[kN]	15,2	29,6	52,8
	HIT-V 8.8(F)	[kN]	24,0	48,0	84,0
	HIT-V-R	[kN]	16,7	33,4	59,1
	HIT-V-HCR	[kN]	24,0	48,0	84,0

Design tension and shear resistances – Steel failure for internally threaded rods HIT-IC

Anchor size			M8	M10	M12
$N_{Rd,s}$	HIT-IC	[kN]	3,9	4,8	9,1
$V_{Rd,s}$	HIT-V 5.8	[kN]	7,2	12,0	16,8
	Screw 8.8	[kN]	12,0	18,4	27,2
$M^0_{Rd,s}$	HIT-V 5.8	[kN]	15,2	29,6	52,8
	Screw 8.8	[kN]	24,0	48,0	84,0



Design tension and shear resistances – Pull-out failure of the anchor, brick breakout failure and local brick failure at characteristic edge distance ($c \geq c_{cr} = c_{min}$) for single anchor applications

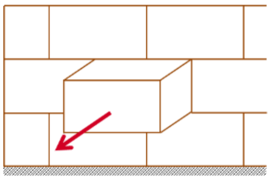
Load type	Anchor size		h_{ef} [mm]	f_b [N/mm²]	w/w and w/d Ta	w/w and w/d Tb	d/d Ta	d/d Tb
					Loads [kN]			
	**SC - Solid clay brick Mz, 2DF**							
$N_{Rd,p}$ = $N_{Rd,b}$ (c_{cr} = c_{min} = 115mm)	HIT-V	M8, M10, M12	80	12	1,2	1,0	1,2	1,0
	HIT-IC	M8			1,2	1,0	1,2	1,0
	HIT-IC	M10, M12			1,6	1,4	1,6	1,4
	HIT-V + HIT-SC	M8, M10, M12			1,6	1,4	1,6	1,4
	HIT-IC + HIT-SC	M8, M10, M12			1,6	1,4	1,6	1,4
$V_{Rd,b}$ (c_{cr} = c_{min} = 115mm)	HIT-V HIT-V + HIT-SC HIT-IC HIT-IC + HIT-SC	M8, M10, M12 M8, M10, M12 M8, M10, M12 M8, M10, M12	80	12	1,4	1,4	1,4	1,4
	**HC - Hollow clay brick Hlz, 10DF**							
$N_{Rd,p}$ = $N_{Rd,b}$ (c_{cr} = c_{min} = 150 mm)	HIT-V + HIT-SC HIT-IC + HIT-SC	M8, M10, M12 M8, M10, M12	80	12	1,2	1,0	1,2	1,0
				20	1,4	1,2	1,4	1,2
$V_{Rd,b}$ (c_{cr} = c_{min} = 150 mm)	HIT-V + HIT-SC HIT-IC + HIT-SC	M8, M10, M12 M8, M10, M12	80	12	0,8	0,8	0,8	0,8
				20	1,2	1,2	1,2	1,2
	**SCS - Solid silica brick KS, 2DF**							
$N_{Rd,p}$ = $N_{Rd,b}$ (c_{cr} = c_{min} = 115 mm)	HIT-V HIT-IC	M8, M10, M12 M8,M10, M12	80	12	2,2	2,0	2,4	2,0
				28	3,4	3,0	3,4	3,0
	HIT-V + HIT-SC HIT-IC + HIT-SC	M8, M10, M12 M8, M10, M12		12	1,6	1,4	2,2	2,0
				28	2,4	2,2	3,2	3,0
$V_{Rd,b}$ (c_{cr} = c_{min} = 115 mm)	HIT-V HIT-V + HIT-SC HIT-IC HIT-IC + HIT-SC	M8, M10, M12 M8, M10, M12 M8, M10, M12 M8, M10, M12	80	12	1,6	1,6	1,6	1,6
				28	2,4	2,4	2,4	2,4
	**HCS - Hollow silica brick KSL, 8DF**							
$N_{Rd,p}$ = $N_{Rd,b}$ (c_{cr} = c_{min} = 125 mm)	HIT-V + HIT-SC HIT-IC + HIT-SC	M8, M10, M12 M8, M10, M12	80	12	1,2	1,0	1,4	1,2
				20	1,6	1,4	2,0	1,8
$V_{Rd,b}$ (c_{cr} = c_{min} = 125 mm)	HIT-V + HIT-SC HIT-IC + HIT-SC	M8, M10, M12 M8, M10, M12	80	12	3,4	3,4	3,4	3,4
				20	4,8	4,8	4,8	4,8

Design tension and shear resistances – Pull out and pushing out of one brick failures

Pull out of one brick (tension):

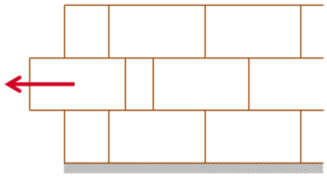
$N_{Rd,pb} = 2 \cdot l \cdot b \cdot (0{,}5 \cdot f_{vko} + 0{,}4 \cdot \sigma_d) / (2{,}5 \cdot 1000)$ [kN]

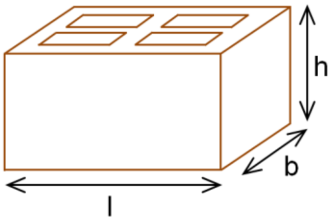
$N_{Rd,pb}^* = (2 \cdot l \cdot b \cdot (0{,}5 \cdot f_{vko} + 0{,}4 \cdot \sigma_d) + b \cdot h \cdot f_{vko}) / (2{,}5 \cdot 1000)$ [kN]
* this equation is applicable if the vertical joints are filled



Pushing out of one brick (shear):

$V_{Rd,pb} = 2 \cdot l \cdot b \cdot (0{,}5 \cdot f_{vko} + 0{,}4 \cdot \sigma_d) / (2{,}5 \cdot 1000)$ [kN]





σ_d = design compressive stress perpendicular to the shear (N/mm^2)
f_{vko} = initial shear strength according to EN 1996-1-1, Table 3.4

Brick type	Mortar strength	f_{vko} [N/mm^2]
Clay brick	M2,5 to M9	0,20
	M10 to M20	0,30
All other types	M2,5 to M9	0,15
	M10 to M20	0,20

On-site test


For other bricks in solid or hollow masonry, not covered by the Hilti HIT-HY 170 ETA or this technical data manual, the characteristic resistance may be determined by on-site tension tests (pull-out tests or proof-load tests), according to ETAG029, Annex B.

For the evaluation of test results, the characteristic resistance may be obtained taking into account the β factor, which considers the different influences of the product.

The β factor for the brick types covered by the Hilti HIT-HY 170 ETA is provided on the following table:

Use categories		**w/w and w/d**		**d/d**	
Temperature range		**Ta***	**Tb***	**Ta***	**Tb***
Base material	**Elements**				
Solid clay brick	HIT-V or HIT-IC	0,97	0,83	0,97	0,83
	HIT-V + HIT-SC				
	HIT-IC + HIT-SC				
Solid calcium silicate brick	HIT-V or HIT-IC	0,96	0,84	0,97	0,84
	HIT-V + HIT-SC	0,69	0,62	0,91	0,82
	HIT-IC + HIT-SC				
Hollow clay brick	HIT-V + HIT-SC	0,97	0,83	0,97	0,83
	HIT-IC + HIT-SC				
Hollow calcium silicate brick	HIT-V + HIT-SC	0,69	0,62	0,91	0,82
	HIT-IC + HIT-SC				

*Ta / Tb, w/w and d/d anchorage parameters, as defined on Table page 5

Applying the β factor from the table above, the characteristic tension resistance N_{Rk} can be obtained. Characteristic shear resistance V_{Rk} can also be directly derived from N_{Rk}. For detailed procedure consult ETAG 029, Annex B.

Materials

Material quality HIT-V

Part	Material
Threaded rod HIT-V-5.8(F)	Strength class 5.8, A_5 > 8% ductile Electroplated zinc coated ≥ 5 μm; (F) Hot dip galvanized ≥ 45 μm
Threaded rod HIT-V-8.8(F)	Strength class 8.8, A_5 > 8% ductile Electroplated zinc coated ≥ 5 μm; (F) Hot dip galvanized ≥ 45 μm
Threaded rod HIT-V-R	Stainless steel grade A4 A_5 > 8% ductile strength class 70, 1.4401; 1.4404; 1.4578; 1.4571; 1.4439; 1.4362
Threaded rod HIT-V-HCR	High corrosion resistant steel, A_5 > 8% ductil 1.4529, 1.4565
Washer	Electroplated zinc coated, hot dip galvanized
	Stainless steel 1.4401; 1.4404; 1.4578; 1.4571; 1.4439; 1.4362
	High corrosion resistant steel 1.4529, 1.4565
Hexagon nut	Strength class 8 Electroplated zinc coated ≥ 5 μm Hot dip galvanized ≥ 45 μm
	Strength class 70 Stainless steel grade A4 1.4401; 1.4404; 1.4578; 1.4571; 1.4439; 1.4362
	Strength class 70 High corrosion resistant steel 1.4529, 1.4565

Material quality HIT-IC

Part	Material
Internally threaded sleeve HIT-IC	A_5 > 8% ductile Electroplated zinc coated ≥ 5 μm

Material quality HIT-SC

Part	Material
Sieve sleeve HIT-SC	Frame: Polyfort FPP 20T Sieve: PA6.6 N500/200

Base materials:

- Solid brick masonry. The characteristic resistances are also valid for larger brick sizes and larger compressive strengths of the masonry unit.
- Hollow brick masonry
- Mortar strength class of the masonry: M2,5 at minimum according to EN 998-2: 2010.
- For other bricks in solid masonry and in hollow or perforated masonry, the characteristic resistance of the anchor may be determined by on-site tests according to ETAG 029, Annex B under consideration of the β-factor according to Table page 9.

Setting

Installation equipment

Anchor size	M8	M10	M12
Rotary hammer	TE2(A) – TE30(A)		
Other tools	blow out pump, set of cleaning brushes, HDE/HDM dispenser		

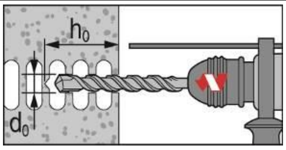
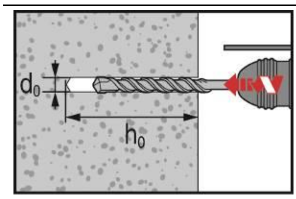
Maximum working time and minimum curing time

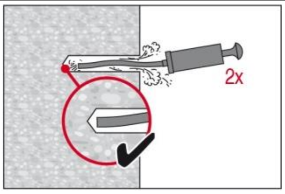
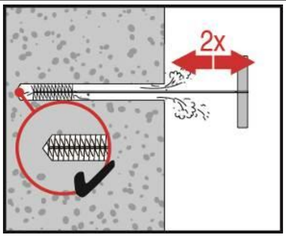
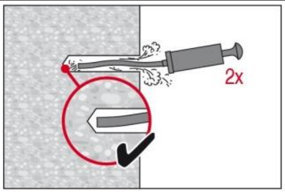
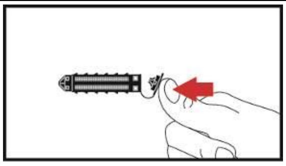
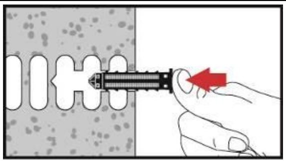
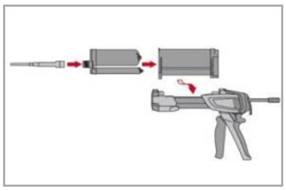
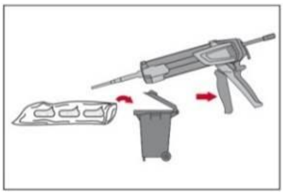
Temperature in the base material T	Maximum working time t_{work}	Minimum curing time t_{cure}
-5 °C to 0 °C *	10 min	12 h
> 0 °C to 5 °C *	10 min	5 h
> 5 °C to 10 °C	8 min	2,5 h
> 10 °C to 20 °C	5 min	1,5 h
> 20 °C to 30 °C	3 min	45 min
> 30 °C to 40 °C	2 min	30 min

The curing time data are valid for dry base material only. In wet base material the curing times must be doubled.
* For hollow bricks only.

Installation instructions

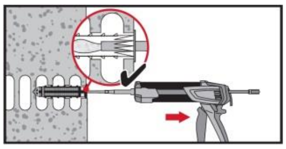
Anchor installation should be carried out by appropriately qualified personnel and under the supervision of the person responsible for technical matters of the site.

Hole drilling	If no significant resistance is felt over the entire depth of the hole when drilling (e.g. in unfilled butt joints), the anchor should not be set at this position
Drilling mode	
	**In hollow bricks: rotary mode** Drill hole to the required embedment depth with a hammer drill set in rotation mode using an appropriately sized carbide drill bit.
	**In solid bricks: hammer mode** Drill hole to the required embedment depth with a hammer drill set in hammer mode using an appropriately sized carbide drill bit.

Drill hole cleaning	Just before setting the anchor, the drill hole must be free of dust and debris. Inadequate hole cleaning = poor load values.
Manual Cleaning (MC) or Compressed Air Cleaning (CAC) for hollow and solid bricks	
	Blow out at least 2 times from the back of the drill hole with the Hilti hand pump until return air stream is free of noticeable dust.
	Brush 2 times with the specified steel brush by inserting the steel brush Hilti HIT-RB to the back of the hole 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 out again with the Hilti hand pump at least 2 times until return air stream is free of noticeable dust.
Injection preparation in masonry with holes or voids: installation with sieve sleeve HIT-SC	
	**Sieve sleeve HIT-SC** Close lid
	Insert sieve sleeve manual.
For all applications	
	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 foil pack. 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.
	Discard initial adhesive. 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. Discarded quantities are 2 strokes for 330 ml foil pack, 3 strokes for 500 ml foil pack.

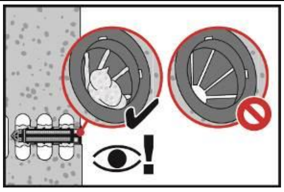
Inject adhesive without forming air voids

Installation with sieve sleeve HIT-SC



Sieve sleeve HIT-SC

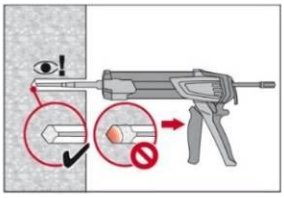
Insert mixer approximately 1 cm through the lid. Adhesive must emerge through the lid.



Control amount of injected mortar. Adhesive has to protrude into the lid.

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

Solid bricks: installation without sieve sleeve

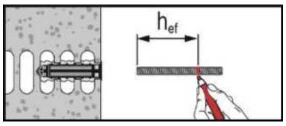


Inject the adhesive starting at the back of the hole, slowly withdrawing the mixer with each trigger pull.

Fill holes approximately 2/3 full, or as required to ensure that the annular gap between the anchor and the base material 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.

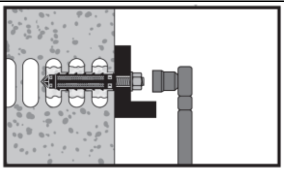
Setting the element: Before use, verify that the element is dry and free of oil and other contaminants.



HIT-V-… or HIT-IC in hollow and solid bricks:
Pre-setting:

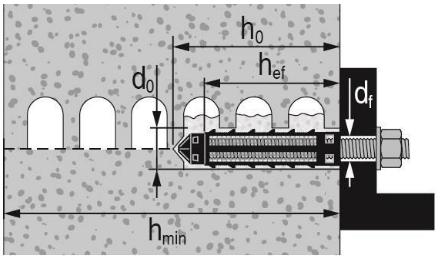
Mark and set element to the required embedment depth until working time t_{work} has elapsed.

Loading the anchor



After required curing time t_{cure}, the anchor can be loaded.
The applied installation torque shall not exceed the values T_{max}.

Applications for hollow and solid bricks with sieve sleeves



Hollow brick with threaded rod HIT-V or internally threaded sleeve HIT-IC and sieve sleeve HIT-SC

Installation parameters of HIT-V-… with sieve sleeve HIT-SC in hollow brick or solid brick

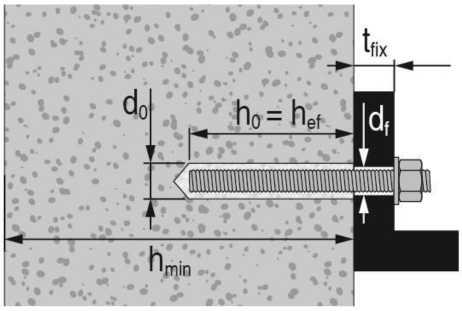
Threaded rods and HIT-V			**M8**	**M10**	**M12**
with HIT-SC			**16x85**		**18x85**
Nominal diameter of drill bit	d_0	[mm]	16	16	18
Drill hole depth	h_0	[mm]	95	95	95
Effective embedment depth	h_{ef}	[mm]	80	80	80
Maximum diameter of clearance hole in the fixture	d_f	[mm]	9	12	14
Minimum wall thickness	h_{min}	[mm]	115	115	115
Brush HIT-RB	-	[-]	16	16	18
Number of strokes HDM	-	[-]	6	6	8
Number of strokes HDE 500-A	-	[-]	5	5	6
Maximum torque moment	T_{max}	[Nm]	3	4	6

Installation parameters of HIT-IC with sieve sleeve HIT-SC in hollow brick or solid brick

Internally threaded sleeve HIT-IC			**M8x80**	**M10x80**	**M12x80**
with HIT-SC			**16x85**	**18x85**	**22x85**
Nominal diameter of drill bit	d_0	[mm]	16	18	22
Drill hole depth	h_0	[mm]	95	95	95
Effective embedment depth	h_{ef}	[mm]	80	80	80
Thread engagement length	h_s	[mm]	8…75	10…75	12…75
Maximum diameter of clearance hole in the fixture	d_f	[mm]	9	12	14
Minimum wall thickness	h_{min}	[mm]	115	115	115
Brush HIT-RB	-	[-]	16	18	22
Number of strokes HDM	-	[-]	6	8	10
Number of strokes HDE-500	-	[-]	5	6	8
Maximum torque moment	T_{max}	[Nm]	3	4	6

Applications for solid bricks without sieve sleeves

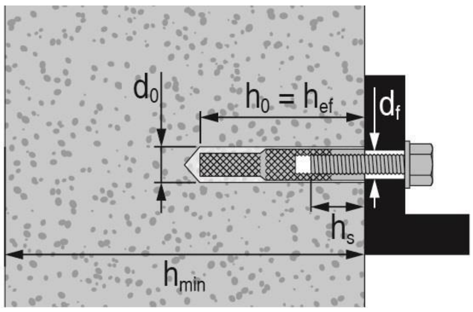
Hilti recommends the anchoring in masonry always with sieve sleeve. Anchors can only be installed without sieve sleeves in solid bricks when it is guaranteed that it has not any hole or void.



Solid brick with threaded rod HIT-V

Installation parameters of threaded rods and HIT-V in solid brick

Threaded rods and HIT-V			M8	M10	M12
Nominal diameter of drill bit	d_0	[mm]	10	12	14
Drill hole depth = Effective embedment depth	h_0= h_{ef}	[mm]	80	80	80
Maximum diameter of clearance hole in the fixture	d_f	[mm]	9	12	14
Minimum wall thickness	h_{min}	[mm]	115	115	115
Brush HIT-RB	-	[-]	10	12	14
Maximum torque moment	T_{max}	[Nm]	5	8	10



Solid brick with internally threaded sleeve HIT-IC

Installation parameters of internally threaded sleeve HIT-IC in solid brick

Internally threaded sleeve HIT-IC			M8x80	M10x80	M12x80
Nominal diameter of drill bit	d_0	[mm]	14	16	18
Drill hole depth = Effective embedment depth	h_0= h_{ef}	[mm]	80	80	80
Thread engagement length	h_s	[mm]	8…75	10…75	12…75
Maximum diameter of clearance hole in the fixture	d_f	[mm]	9	12	14
Minimum wall thickness	h_{min}	[mm]	115	115	115
Brush HIT-RB	-	[-]	14	16	18
Maximum torque moment	T_{max}	[Nm]	5	8	10