Centre Scientifique et Technique du Bâtiment
84 avenue Jean Jaurès
CHAMPS-SUR-MARNE
F-77447 Marne-la-Vallée Cedex 2

Tél. : (33) 01 64 68 82 82
Fax : (33) 01 60 05 70 37

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European Technical Assessment

ETA-02/0042 of 22/11/2017

English translation prepared by CSTB - Original version in French language

General Part

Nom commercial *Trade name*	**Hilti HSL-3, HSL-3-R**
Famille de produit *Product family*	**Cheville métallique à expansion par vissage à couple contrôlé, pour béton fissuré et non fissuré** ***Torque-controlled expansion anchor for use in cracked and non-cracked concrete***
Titulaire *Manufacturer*	Hilti Corporation Feldkircherstrasse 100 FL-9494 Schaan Principality of Liechtenstein
Usine de fabrication *Manufacturing plants*	Hilti plants
Cette évaluation contient: *This assessment contains*	37 pages incluant 34 pages d'annexes qui font partie intégrante de cette évaluation 37 *pages including 34 pages of annexes which form an integral part of this assessment*
Base de l'ETE *Basis of ETA*	DEE 330232-00-0601 "Ancrages mécaniques dans le béton" *EAD* 330232-00-0601 "Mechanical fasteners for use in concrete"
Cette évaluation remplace: *This assessment replaces*	ETE-02/0042 issue le 07/09/2015 *ETA-02/0042 issued on 07/09/2015*

Specific Part

Technical description of the product

The Hilti heavy duty HSL-3 and HSL-3-R anchor is a torque-controlled expansion anchor made of galvanised or stainless steel which is placed into a drilled hole and anchored by torque controlled expansion.

The product description is given in Annexes A.

Specification of the intended use

The performances given in Section 3 are only valid if the anchor is used in compliance with the specifications and conditions given in Annexes B.

The verifications and assessment methods on which this European Technical Assessment is based lead to the assumption of a working life of the anchor at least 50 years. The indications given on the working life cannot be interpreted as a guarantee given by the producer, but are to be regarded only as a means for choosing the right products in relation to the expected economically reasonable working life of the works.

Performance of the product

1.1 Mechanical resistance and stability (BWR 1)

Essential characteristic	Performance
Characteristic tension resistance in case of static and quasi-static loading according ETAG001, Annex C and CEN/TS 1992-4	See Annex C1, C2
Characteristic shear resistance in case of static and quasi-static loading according ETAG001, Annex C and CEN/TS 1992-4	See Annex C3, C4
Displacements under tension and shear loads in case of static and quasi-static loading	See Annex C5, C6
Characteristic tension resistance in case of seismic performance category C1 according EOTA TR045	See Annex C7, C8
Characteristic shear resistance in case of seismic performance category C1 according EOTA TR045	See Annex C9
Displacements under tension and shear loads in case of seismic performance category C1, according EOTA TR045	See Annex C10
Characteristic tension resistance in case of seismic performance category C2 according EOTA TR045	See Annex C11
Characteristic shear resistance in case of seismic performance category C2 according EOTA TR045	See Annex C12
Displacements under tension and shear loads in case of seismic performance category C2 according EOTA TR045	See Annex C13

1.2 Safety in case of fire (BWR 2)

Essential characteristic	Performance
Reaction to fire	Anchorages satisfy requirements for Class A1
Resistance to fire	See Annex C14, C15, C16, C17, C18

1.3 Hygiene, health and the environment (BWR 3)

Regarding dangerous substances contained in this European technical approval, there may be requirements applicable to the products falling within its scope (e.g. transposed European legislation and national laws, regulations and administrative provisions). In order to meet the provisions of the Construction Products Directive, these requirements need also to be complied with, when and where they apply.

1.4 Safety in use (BWR 4)

The essential characteristics regarding Safety in use are included under the Basic Works Requirement Mechanical resistance and stability.

1.5 Protection against noise (BWR 5)

Not relevant.

1.6 Energy economy and heat retention (BWR 6)

Not relevant.

1.7 Sustainable use of natural resources (BWR 7)

For the sustainable use of natural resources no performance was determined for this product.

1.8 General aspects relating to fitness for use

Durability and Serviceability are only ensured if the specifications of intended use according to Annex B1 are kept.

Assessment and verification of constancy of performance (AVCP)

According to the Decision 96/582/EC of the European Commission[1], as amended, the system of assessment and verification of constancy of performance (see Annex V to Regulation (EU) No 305/2011) given in the following table apply.

Product	Intended use	Level or Class	System
Metal anchors for use in concrete	For fixing and/or supporting to concrete, structural elements (which contributes to the stability of the works) or heavy units	—	1

Technical details necessary for the implementation of the AVCP system

Technical details necessary for the implementation of the Assessment and verification of constancy of performance (AVCP) system are laid down in the control plan deposited at Centre Scientifique et Technique du Bâtiment.

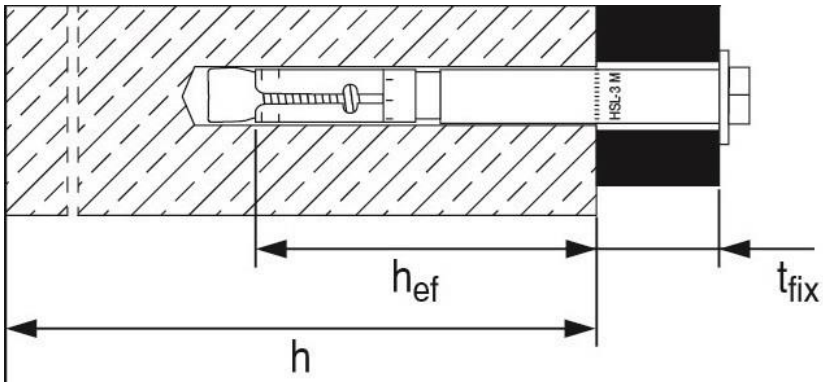
The manufacturer shall, on the basis of a contract, involve a notified body approved in the field of anchors for issuing the certificate of conformity CE based on the control plan.

Issued in Marne La Vallée on 22-11-2017 by

Charles Baloche *The original French version is signed*
Directeur technique

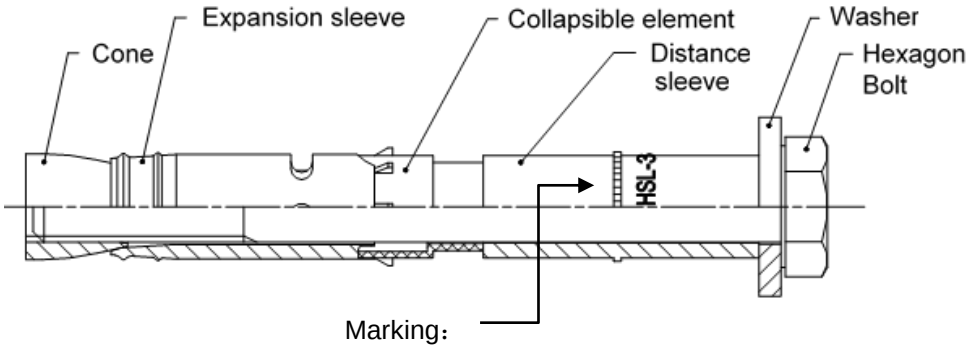
[1] Official Journal of the European Communities L 254 of 08.10.1996

Installed condition



Product description:

Figure A1:
Hilti torque controlled expansion anchor HSL-3(-R)

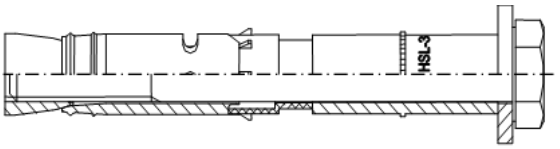


Marking:
e.g.
HSL-3 M10/20
HSL-3-R M10 40/20/-
Anchor type
Anchor size
Max. fixture thickness $t_{fix,1}$/ $t_{fix,2}$/$t_{fix,3}$

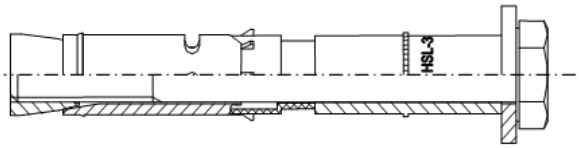
Hilti heavy duty anchor HSL-3(-R)	**Annex A1**
Product description Installed condition and product description	

Product description

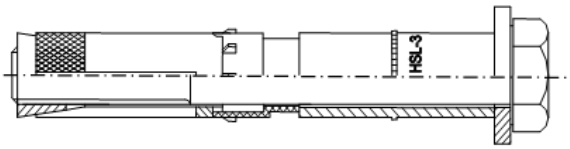
Figure A2:



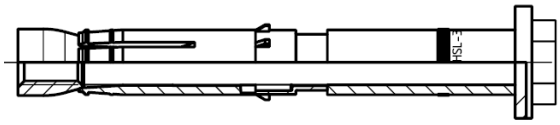
HSL-3…: M8 to M12



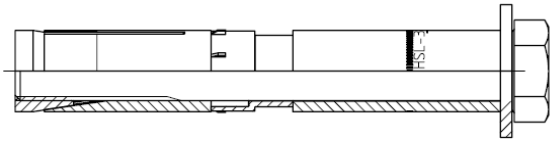
HSL-3…: M16



HSL-3…: M20 to M24

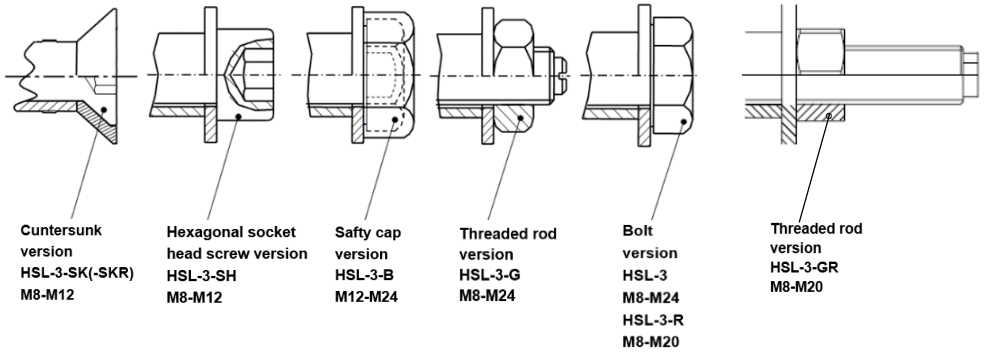


HSL-3-R…: M8 to M16



HSL-3-R…: M20

Figure A3:



Hilti heavy duty anchor HSL-3(-R)	**Annex A2**
Product description Anchor versions and head configurations	

Table A1: Letter code for identification of maximum fixture thickness for identification of anchor for available standard items

Type	HSL-3-R, HSL-3-GR				
Size / Letter	**M8** $t_{fix,1}$/ $t_{fix,2}$/$t_{fix,3}$	**M10** $t_{fix,1}$/ $t_{fix,2}$/$t_{fix,3}$	**M12** $t_{fix,1}$/ $t_{fix,2}$/$t_{fix,3}$	**M16** $t_{fix,1}$/ $t_{fix,2}$/$t_{fix,3}$	**M20** $t_{fix,1}$/ $t_{fix,2}$/$t_{fix,3}$
y	20/-/-(2) (3)	20/-/-(2) (3)	(1)	(1)	(1)
x	(1)	(1)	25/-/-(2) (3)	25/-/-(2) (3)	(1)
w	(1)	(1)	(1)	(1)	30/-/-(2) (3)
c	40/20/- (2)	40/20/- (2) 100/80/60(3)	(1)	(1)	(1)
b	(1)	(1)	50/25/-(2) 100/75/50(3)	50/25/-(2) 100/75/50(3)	(1)
a	100/80/60(3)	(1)	(1)	(1)	60/30/-(2) 100/70/40(3)

Type	HSL-3-SKR		
Size / Letter	**M8** t_{fix}	**M10** t_{fix}	**M12** t_{fix}
z	10	(1)	(1)
y	20	20	(1)
x	(1)	(1)	25

(1) There is no available standard item, check availability of the special items.

(2) HSL-3-R standard items.

(3) HSL-3-GR standard items.

Table A2: Material code for identification of different materials

Type	HSL-3 HSL-3-SK (carbon steel)	HSL-3-B (carbon steel)	HSL-3-R (stainless steel grade A4)	HSL-3-SKR (stainless steel grade A4)
Material code				

Hilti heavy duty anchor HSL-3(-R)	**Annex A3**
Product description Letter code and material code	

Table A3: Materials

Designation	Material
HSL-3, HSL-3-G, HSL-3-B, HSL-3-SH, HSL-3-SK (Carbon steel)	
Cone	Carbon steel, electroplated zinc coated ≥ 5µm
Expansion sleeve	Carbon steel, electroplated zinc coated ≥ 5µm
Collapsible element	Plastic element
Distance sleeve	Carbon steel, electroplated zinc coated ≥ 5µm
HSL-3	
Washer	Carbon steel, electroplated zinc coated ≥ 5µm
Hexagonal bolt	Carbon steel, electroplated zinc coated ≥ 5µm, rupture elongation ≥ 12%
HSL-3-G	
Hexagon nut	Carbon steel, electroplated zinc coated ≥ 5µm
Threaded rod	Carbon steel, electroplated zinc coated ≥ 5µm, rupture elongation ≥ 12%
HSL-3-B	
Hexagon bolt with safety cap	Carbon steel, electroplated zinc coated ≥ 5µm, rupture elongation ≥ 12%
HSL-3-SH	
Hexagonal socket head screw	Carbon steel, electroplated zinc coated ≥ 5µm, rupture elongation ≥ 12%
HSL-3-SK	
Countersunk bolt	Carbon steel, electroplated zinc coated ≥ 5µm, rupture elongation ≥ 12%
Cup washer	Carbon steel, electroplated zinc coated ≥ 5µm
HSL-3-R, HSL-3-GR, HSL-3-SKR (Stainless steel)	
Cone	Stainless steel A4, coated
Expansion sleeve	Stainless steel A4
Collapsible element	Plastic element
Distance sleeve	Stainless steel A4
HSL-3-R	
Washer	Stainless steel A4, coated
Hexagonal bolt	Stainless steel A4, coated, rupture elongation ≥ 12%
HSL-3-GR	
Hexagon nut	Stainless steel A4, coated
Threaded rod	Stainless steel A4, coated, rupture elongation ≥ 12%
HSL-3-SKR	
Countersunk bolt	Stainless steel A4, coated, rupture elongation ≥ 12%
Cup washer	Stainless steel A4, coated

Specifications of intended use

Anchorages subject to:

- Static and quasi-static loading: all sizes.
- Seismic performance category C1 and C2: sizes see Table B1.

Base materials:

- Reinforced or unreinforced normal weight concrete according to EN 206:2013.
- Strength classes C20/25 to C50/60 according to EN 206:2013.
- Cracked and non-cracked concrete.

Use conditions (Environmental conditions):

- HSL-3, HSL-3-G, HSL-3-B, HSL-3-SH, HSL-3-SK made of galvanized steel:
  Structures subject to dry internal conditions.
- HSL-3-R, HSL-3-GR, HSL-3-SKR made of stainless steel A4:
  Structures subject to dry internal conditions and also in structures subject to external atmospheris exposure (including industrial and marine environment) or exposure in permanently damp internal conditions, if no particular aggressive conditions exist.
  Note: particular aggressive conditions are e.g. permanent, alternating immersion in seawater or the splash zone of seawater, chloride atmosphere of indoor swimming pools or atmosphere with extreme chemical pollution (e.g. in desulphurization plants or road tunnels, where de-icing products are used).

Design:

- Anchorages are designed under the responsibility of an engineer experienced in anchorages and concrete 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 reloative to reinforcement or to supports etc.).
- Anchorages under static or quasi-static loading are designed in accordance with:
  CEN/TS 1992-4:2009 or ETAG001, Annex C.
- Anchorages under seismic actions (cracked concrete) are designed in accordance with:
  EOTA Technical Report TR 045, Edition February 2013 or CEN/TS 1992-4:2009, Annex D.
- Anchorages shall be positioned outside of critical regions (e.g. plastic hinges) of the concrete structure. Fastenings in stand-off installation or with a grout layer under seismic action are not covered in this European technical assessment (ETA).

Installation:

- Anchor installation carried out by appropriately qualified personnel and under the supervision of the person responsible for technical matters of the site.
- The anchor may only be set once.
- Drilling technique: see Table B1 and Table B2.
- Cleaning the hole of drilling dust.
- In case of aborted hole, drilling of new hole at a minimum distance of twice the depth of the aborted hole, or smaller distance provided the aborted drill hole is filled with high strength mortar and no shear or oblique tension loads in the direction of aborted hole.

Table B1: Specifications of intended use

Anchorages subject to:	**HSL-3**	**HSL3-G**	**HSL-3-B**	**HSL-3-SK**	**HSL-3-SH**
Static and quasi static loading in cracked and non-cracked concrete - hammer drilling and diamond coring	M8-M24	M8-M24	M12-M24	M8-M12	M8-M12
Seismic performance category C1 - hammer drilling and diamond coring	M8-M24	M8-M20	M12-M24	M8-M12	M8-M12
Seismic performance category C2 - hammer drilling only	M10-M20	M10-M20	M12-M20	M10-M12	M10-M12

Anchorages subject to:	**HSL-3-R**	**HSL-3-GR**	**HSL-3-SKR**
Static and quasi static loading in cracked and non-cracked concrete - hammer drilling	M8-M20	M8-M20	M8-M12
Seismic performance category C1 - hammer drilling	M8-M20	M8-M20	M8-M12

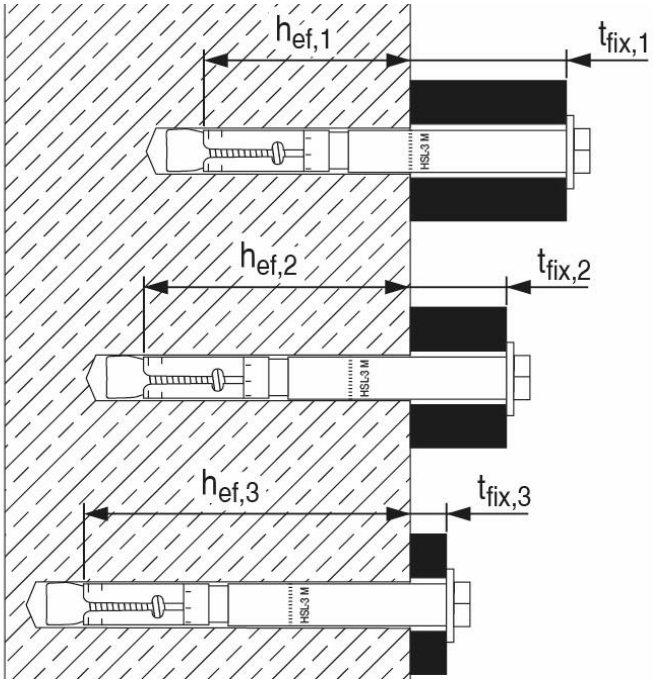
Table B2: Drilling technique

Anchorages subject to:	**HSL-3**	**HSL3-G**	**HSL-3-B**	**HSL-3-SK**	**HSL-3-SH**
Hammer drilling (HD)	M8-M24	M12-M24	M8-M24	M8-M12	M8-M12
Diamond coring (DD) with DD 30-W coring tool and C+ … SPX-T (abrasive) core bits 	M8-M24	M12-M24	M8-M24	M8-M12	M8-M12
Diamond coring (DD) with DD 120 coring tool and DD-BI core bits 	M20-M24	M20-M24	M20-M24	-	-

Anchorages subject to:	**HSL-3-R**	**HSL-3-GR**	**HSL-3-SKR**
Hammer drilling (HD)	M8-M20	M8-M20	M8-M12

Setting positions for HSL-3(-R), HSL-3-G(-GR), HSL-3-B

Constant anchor length with various fixture thicknesses $t_{fix,i}$ and corresponding setting position.



Setting position ①

Setting position ②

Setting position ③

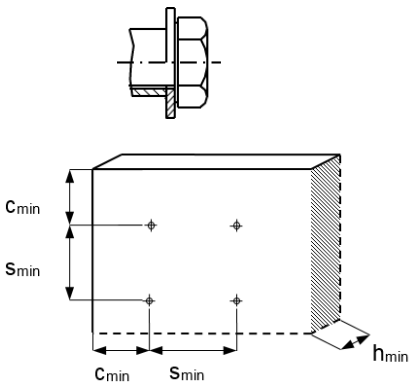
Hilti heavy duty anchor HSL-3(-R)	**Annex B3**
Intended use Installation parameters	

Table B3: Installation parameters HSL-3

HSL-3			**M8**			**M10**			**M12**			**M16**			**M20**			**M24**		
Nominal diameter of drill bit	d_0	[mm]	12			15			18			24			28			32		
Max. cutting diameter of drill bit	d_{cut}	[mm]	12,5			15,5			18,5			24,55			28,55			32,7		
Max. diameter of clearance hole in the fixture	d_f	[mm]	14			17			20			26			31			35		
Setting position	i		①	②	③	①	②	③	①	②	③	①	②	③	①	②	③	①	②	③
Fixture thickness	t_{fix1}	[mm]	5 - 200			5 - 200			5 - 200			10 - 200			10 - 200			10 - 200		
Effective fixture thickness	$t_{fix,i}$		$t_{fix,1}$[1)] - Δ_i																	
Reduction of fixture thickness	Δ_i	[mm]	0	20	40	0	20	40	0	25	50	0	25	50	0	30	60	0	30	60
Effective anchorage depth	$h_{ef,i}$	[mm]	60	80	100	70	90	110	80	105	130	100	125	150	125	155	185	150	180	210
Min. depth of drill hole	$h_{1,i}$	[mm]	80	100	120	90	110	130	105	130	155	125	150	175	155	185	215	180	210	240
Min. thickness of concrete member	$h_{min,i}$	[mm]	120	170	190	140	195	215	160	225	250	200	275	300	250	380	410	300	405	435
Width across flats	SW	[mm]	13			17			19			24			30			36		
Installation torque	T_{inst}	[Nm]	25			50			80			120			200			250		
Non-cracked and cracked concrete																				
Minimum spacing	s_{min}	[mm]	60			70			80			100			125			150		
	$c \geq$	[mm]	100			100			160			240			300			300		
Minimum edge distance	c_{min}	[mm]	60			70			80			100			150			150		
	$s \geq$	[mm]	100			160			240			240			300			300		

[1)] Predefined fixture thickness t_{fix} according to anchor specification, see Figure A1.

HSL-3 Bolt version



Hilti heavy duty anchor HSL-3(-R)

Annex B4

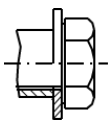
Intended use
Installation parameters HSL-3

Table B4: Installation parameters HSL-3-R

HSL-3-R			**M8**			**M10**			**M12**			**M16**			**M20**		
Nominal diameter of drill bit	d_0	[mm]	12			15			18			24			28		
Max. cutting diameter of drill bit	d_{cut}	[mm]	12,5			15,5			18,5			24,55			28,55		
Max. diameter of clearance hole in the fixture	d_f	[mm]	14			17			20			26			31		
Setting position	i		①	②	③	①	②	③	①	②	③	①	②	③	①	②	③
Fixture thickness	t_{fix1}	[mm]	5 - 200			5 - 200			5 - 200			10 - 200			10 - 200		
Effective fixture thickness	$t_{fix,i}$		$t_{fix,1}$[1)] - Δ_i														
Reduction of fixture thickness	Δ_i	[mm]	0	20	40	0	20	40	0	25	50	0	25	50	0	30	60
Effective anchorage depth	$h_{ef,i}$	[mm]	60	80	100	70	90	110	80	105	130	100	125	150	125	155	185
Min. depth of drill hole	$h_{1,i}$	[mm]	80	100	120	90	110	130	105	130	155	125	150	175	155	185	215
Min. thickness of concrete member	$h_{min,i}$	[mm]	120	170	195	140	195	215	160	225	250	200	275	300	250	380	410
Width across flats	SW	[mm]	13			17			19			24			30		
Installation torque	T_{inst}	[Nm]	25			35			80			120			200		
Cracked concrete																	
Minimum spacing	s_{min}	[mm]	70			70			80			100			125		
	$c \geq$	[mm]	100			100			160			240			300		
Minimum edge distance	c_{min}	[mm]	70			80			80			100			150		
	$s \geq$	[mm]	140			160			240			240			300		
Non-cracked concrete																	
Minimum spacing	s_{min}	[mm]	70			70			80			100			125		
	$c \geq$	[mm]	100			100			170			240			300		
Minimum edge distance	c_{min}	[mm]	70			120			80			100			150		
	$s \geq$	[mm]	140			160			240			240			300		

[1)] Predefined fixture thickness t_{fix} according to anchor specification, see Figure A1.

HSL-3-R Bolt version



Hilti heavy duty anchor HSL-3(-R)

Annex B5

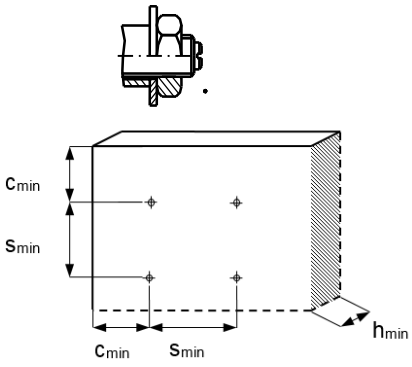
Intended use
Installation parameters HSL-3-R

Table B5: Installation parameters HSL-3-G

HSL-3-G			**M8**			**M10**			**M12**			**M16**			**M20**			**M24**		
Nominal diameter of drill bit	d_0	[mm]	12			15			18			24			28			32		
Max. cutting diameter of drill bit	d_{cut}	[mm]	12,5			15,5			18,5			24,55			28,55			32,7		
Max. diameter of clearance hole in the fixture	d_f	[mm]	14			17			20			26			31			35		
Setting position	i		①	②	③	①	②	③	①	②	③	①	②	③	①	②	③	①	②	③
Fixture thickness	t_{fix1}	[mm]	5 - 200			5 - 200			5 - 200			10 - 200			10 - 200			10 - 200		
Effective fixture thickness	$t_{fix,i}$		$t_{fix,1}$[1)] - Δ_i																	
Reduction of fixture thickness	Δ_i	[mm]	0	20	40	0	20	40	0	25	50	0	25	50	0	30	60	0	30	60
Effective anchorage depth	$h_{ef,i}$	[mm]	60	80	100	70	90	110	80	105	130	100	125	150	125	155	185	150	180	210
Min. depth of drill hole	$h_{1,i}$	[mm]	80	100	120	90	110	130	105	130	155	125	150	175	155	185	215	180	210	240
Min. thickness of concrete member	$h_{min,i}$	[mm]	120	170	190	140	195	215	160	225	250	200	275	300	250	380	410	300	405	435
Width across flats	SW	[mm]	13			17			19			24			30			36		
Installation torque	T_{inst}	[Nm]	20			35			60			80			160			180		
Non-cracked and cracked concrete																				
Minimum spacing	s_{min}	[mm]	60			70			80			100			125			150		
	$c \geq$	[mm]	100			100			160			240			300			300		
Minimum edge distance	c_{min}	[mm]	60			70			80			100			150			150		
	$s \geq$	[mm]	100			160			240			240			300			300		

[1)] Predefined fixture thickness t_{fix} according to anchor specification, see Figure A1.

HSL-3-G Threaded rod version



Hilti heavy duty anchor HSL-3(-R)	**Annex B6**
Intended use Installation parameters HSL-3-G	

Table B6: Installation parameters HSL-3-GR

HSL-3-GR			**M8**			**M10**			**M12**			**M16**			**M20**		
Nominal diameter of drill bit	d_0	[mm]	12			15			18			24			28		
Max. cutting diameter of drill bit	d_{cut}	[mm]	12,5			15,5			18,5			24,55			28,55		
Max. diameter of clearance hole in the fixture	d_f	[mm]	14			17			20			26			31		
Setting position	i		①	②	③	①	②	③	①	②	③	①	②	③	①	②	③
Fixture thickness	t_{fix1}	[mm]	5 - 200			5 - 200			5 - 200			10 - 200			10 - 200		
Effective fixture thickness	$t_{fix,i}$		$t_{fix,1}$[1)] - Δ_i														
Reduction of fixture thickness	Δ_i	[mm]	0	20	40	0	20	40	0	25	50	0	25	50	0	30	60
Effective anchorage depth	$h_{ef,i}$	[mm]	60	80	100	70	90	110	80	105	130	100	125	150	125	155	185
Min. depth of drill hole	$h_{1,i}$	[mm]	80	100	120	90	110	130	105	130	155	125	150	175	155	185	215
Min. thickness of concrete member	$h_{min,i}$	[mm]	120	170	195	140	195	215	160	225	250	200	275	300	250	380	410
Width across flats	SW	[mm]	13			17			19			24			30		
Installation torque	T_{inst}	[Nm]	30			50			80			120			200		
Cracked concrete																	
Minimum spacing	s_{min}	[mm]	70			70			80			100			125		
	$c \geq$	[mm]	100			100			160			240			300		
Minimum edge distance	c_{min}	[mm]	70			80			80			100			150		
	$s \geq$	[mm]	140			160			240			240			300		
Non-cracked concrete																	
Minimum spacing	s_{min}	[mm]	70			70			80			100			125		
	$c \geq$	[mm]	100			100			170			240			300		
Minimum edge distance	c_{min}	[mm]	70			120			80			100			150		
	$s \geq$	[mm]	140			160			240			240			300		

[1)] Predefined fixture thickness t_{fix} according to anchor specification, see Figure A1.

HSL-3-GR Threaded rod version

Hilti heavy duty anchor HSL-3(-R)

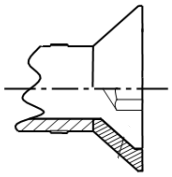
Annex B7

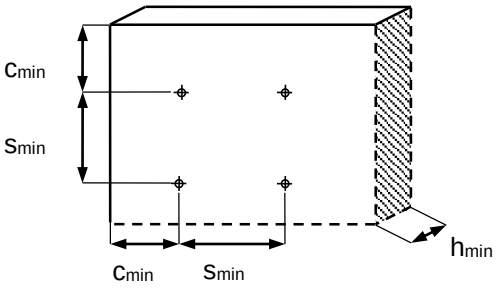
Intended use
Installation parameters HSL-3-GR

Table B7: Installation parameters HSL-3-SK

HSL-3-SK			**M8**	**M10**	**M12**
Nominal diameter of drill bit	d_0	[mm]	12	15	18
Max. cutting diameter of drill bit	d_{cut}	[mm]	12,5	15,5	18,5
Max. diameter of clearance hole in the fixture	d_f	[mm]	14	17	20
Diameter of countersunk hole in the fixture	d_h	[mm]	22,5	25,5	32,9
Height of countersunk head in the fixture	h_{cs}	[mm]	5,8	5,8	8,0
Fixture thickness	t_{fix}	[mm]	10 - 20	20	25
Effective anchorage depth	h_{ef}	[mm]	60	70	80
Min. depth of drill hole	h_1	[mm]	80	90	105
Min. thickness of concrete member	h_{min}	[mm]	120	140	160
Hexagon socket screw key	SW	[mm]	5	6	8
Installation torque	T_{inst}	[Nm]	25	50	80
Non-cracked and cracked concrete					
Minimum spacing	s_{min}	[mm]	60	70	80
	$c \geq$	[mm]	100	100	160
Minimum edge distance	c_{min}	[mm]	60	70	80
	$s \geq$	[mm]	100	160	240

HSL-3-SK Countersunk version





Hilti heavy duty anchor HSL-3(-R)	**Annex B8**
Intended use Installation parameters HSL-3-SK	

Table B8: Installation parameters HSL-3-SKR

HSL-3-SKR			**M8**	**M10**	**M12**
Nominal diameter of drill bit	d_0	[mm]	12	15	18
Max. cutting diameter of drill bit	d_{cut}	[mm]	12,5	15,5	18,5
Max. diameter of clearance hole in the fixture	d_f	[mm]	14	17	20
Diameter of countersunk hole in the fixture	d_h	[mm]	22,5	25,5	32,9
Height of countersunk head in the fixture	h_{cs}	[mm]	5,8	6,0	8,0
Fixture thickness	t_{fix}	[mm]	10 - 20	20	25
Effective anchorage depth	h_{ef}	[mm]	60	70	80
Min. depth of drill hole	h_1	[mm]	80	90	105
Min. thickness of concrete member	h_{min}	[mm]	120	140	160
Hexagon socket screw key	SW	[mm]	5	6	8
Installation torque	T_{inst}	[Nm]	18	50	80
Cracked concrete					
Minimum spacing	s_{min}	[mm]	70	70	80
	$c \geq$	[mm]	100	100	160
Minimum edge distance	c_{min}	[mm]	70	80	80
	$s \geq$	[mm]	140	160	240
Non-cracked concrete					
Minimum spacing	s_{min}	[mm]	70	70	80
	$c \geq$	[mm]	100	100	170
Minimum edge distance	c_{min}	[mm]	70	120	80
	$s \geq$	[mm]	140	160	240

HSL-3-SKR Countersunk version

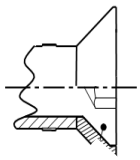
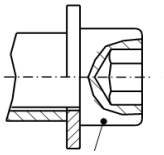
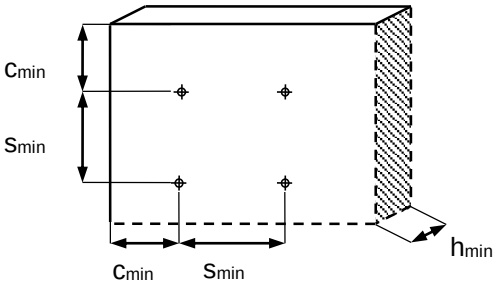


Table B9: Installation parameters HSL-3-SH

HSL-3-SH			**M8**	**M10**	**M12**
Nominal diameter of drill bit	d_0	[mm]	12	15	18
Max. cutting diameter of drill bit	d_{cut}	[mm]	12,5	15,5	18,5
Max. diameter of clearance hole in the fixture	d_f	[mm]	14	17	20
Fixture thickness	t_{fix}	[mm]	5	20	25
Effective anchorage depth	h_{ef}	[mm]	60	70	80
Min. depth of drill hole	h_1	[mm]	85	95	110
Min. thickness of concrete member	h_{min}	[mm]	120	140	160
Hexagon socket screw key	SW	[mm]	6	8	10
Installation torque	T_{inst}	[Nm]	25	35	60
Non-cracked and cracked concrete					
Minimum spacing	s_{min}	[mm]	60	70	80
	$c \geq$	[mm]	100	100	160
Minimum edge distance	c_{min}	[mm]	60	70	80
	$s \geq$	[mm]	100	160	240

HSL-3-SH Hexagonal socket head version



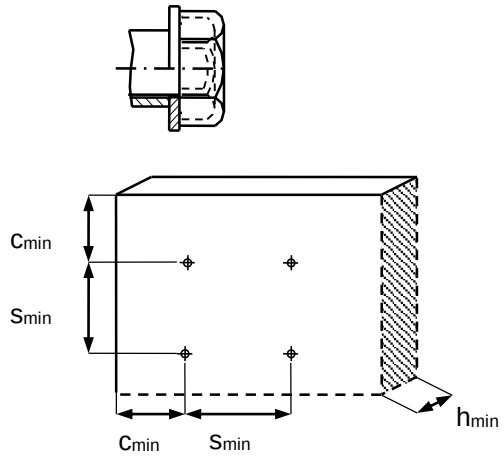


Hilti heavy duty anchor HSL-3(-R)	**Annex B10**
Intended use Installation parameters HSL-3-SH	

Table B10: Installation parameters HSL-3-B

HSL-3-B			**M12**			**M16**			**M20**			**M24**		
Nominal diameter of drill bit	d_0	[mm]	18			24			28			32		
Max. cutting diameter of drill bit	d_{cut}	[mm]	18,5			24,55			28,55			32,7		
Max. diameter of clearance hole in the fixture	d_f	[mm]	20			26			31			35		
Setting position			①	②	③	①	②	③	①	②	③	①	②	③
Fixture thickness	t_{fix1}	[mm]	5 - 200			10 - 200			10 - 200			10 - 200		
Effective fixture thickness	$t_{fix,i}$		$t_{fix,1}$[1)] - Δ_i											
Reduction of fixture thickness	Δ_i	[mm]	0	25	50	0	25	50	0	30	60	0	30	60
Effective anchorage depth	$h_{ef,i}$	[mm]	80	105	130	100	125	150	125	155	185	150	180	210
Min. depth of drill hole	$h_{1,i}$	[mm]	105	130	155	125	150	175	155	185	215	180	210	240
Min. thickness of concrete member	$h_{min,i}$	[mm]	160	225	250	200	275	300	250	380	410	300	405	435
Width across flats	SW	[mm]	24			30			36			41		
Installation torque	T_{inst}	[Nm]	The torque moment is controlled by the safety cap.											
Non-cracked and cracked concrete														
Minimum spacing	s_{min}	[mm]	80			100			125			150		
	$c \geq$	[mm]	160			240			300			300		
Minimum edge distance	c_{min}	[mm]	80			100			150			150		
	$s \geq$	[mm]	240			240			300			300		

HSL-3-B Safety cap version



Hilti heavy duty anchor HSL-3(-R)

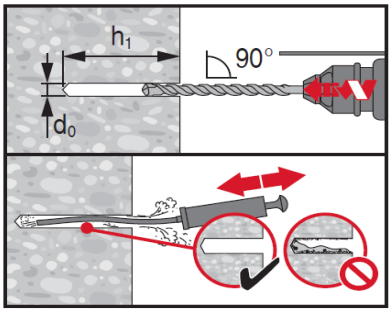
Annex B11

Intended use
Installation parameters HSL-3-B

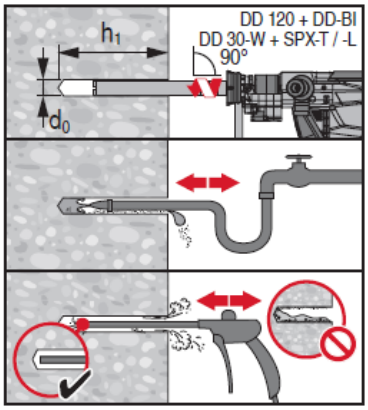
Installation instruction

Hole drilling and cleaning

a) Hammer drilling (HD) with manual cleaning (MC):

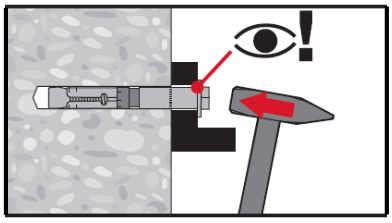


b) Diamond coring (DD) with flushing and blowing



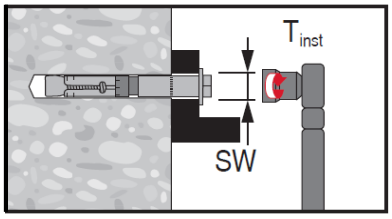
Anchor setting

Hammer setting, check setting



Anchor torqueing

Use torque wrench



Hilti heavy duty anchor HSL-3(-R)	**Annex B12**
Intended use Installation instruction	

Table C1: Characteristic values of resistance under tension load in case of static and quasi-static loading HSL-3(-R), HSL-3-G(-GR), HSL-3-B, HSL-3-SH, HSL-3-SK(-SKR)

Size			**M8**			**M10**			**M12**			**M16**			**M20**			**M24**		
Setting position			①	②	③	①	②	③	①	②	③	①	②	③	①	②	③	①	②	③
Effective anchorage depth	h_{ef}	[mm]	60	80	100	70	90	110	80	105	130	100	125	150	125	155	185	150	180	210
Steel failure																				
HSL-3, HSL-3-G, HSL-3-B, HSL-3-SH, HSL-3-SK																				
Partial safety factor	$\gamma_{Ms,N}$	[-]	1,5																	
HSL-3-GR																				
Partial safety factor	$\gamma_{Ms,N}$	[-]	1,5															-		
HSL-3-R, HSL-3-SKR																				
Partial safety factor	$\gamma_{Ms,N}$	[-]	1,5			1,87												-		
HSL-3, HSL-3-G, HSL-3-B, HSL-3-SH, HSL-3-SK																				
Characteristic resistance	$N_{Rk,s}$	[kN]	29,3			46,4			67,4			125,6			196,0			282,4		
HSL-3-R, HSL-3-GR, HSL-3-SKR																				
Characteristic resistance	$N_{Rk,s}$	[kN]	25,6			40,6			59,0			109,9			171,5			-		
Pullout failure																				
Characteristic resistance in concrete C20/25																				
HSL-3, HSL-3-G, HSL-3-B, HSL-3-SH, HSL-3-SK																				
Installation safety factor	γ_2[1] = γ_{inst}[2]	[-]	1,2			1,0														
HSL-3-R, HSL-3-GR, HSL-3-SKR																				
Installation safety factor	γ_2[1] = γ_{inst}[2]	[-]	1,0															-		
HSL-3, HSL-3-G, HSL-3-B, HSL-3-SH, HSL-3-SK																				
Non cracked concrete	$N_{Rk,p,uncr}$	[kN]	-[3]	-[3]	-[3]	-[3]	-[3]	-[3]	-[3]	-[3]	-[3]	-[3]	65	65	-[3]	95	95	-[3]	100	100
Cracked concrete	$N_{Rk,p,cr}$	[kN]	12	12	12	16	16	16	-[3]	24	24	-[3]	36	36	-[3]	50	50	-[3]	65	65
HSL-3-R, HSL-3-GR, HSL-3-SKR																				
Non cracked concrete	$N_{Rk,p,uncr}$	[kN]	20	20	20	-[3]	-[3]	-[3]	-[3]	50	50	-[3]	65	65	-[3]	95	95	-	-	-
Cracked concrete	$N_{Rk,p,cr}$	[kN]	12	12	12	16	16	16	-[3]	24	24	-[3]	36	36	-[3]	50	50	-	-	-

Hilti heavy duty anchor HSL-3(-R)

Annex C1

Performances
Characteristic resistance under tension load
Design according to CEN/TS 1992-4:2009 or ETAG001, Annex C

Table C1: Continued

Size			**M8**			**M10**			**M12**			**M16**			**M20**			**M24**		
Setting position			①	②	③	①	②	③	①	②	③	①	②	③	①	②	③	①	②	③
Effective anchorage depth	h_{ef}	[mm]	60	80	100	70	90	110	80	105	130	100	125	150	125	155	185	150	180	210
Pullout failure																				
HSL-3, HSL-3-G, HSL-3-B, HSL-3-SH, HSL-3-SK HSL-3-R, HSL-3-GR, HSL-3-SKR																				
Characteristic resistance in concrete C20/25																				
Increasing factor concrete strength ψ_c	C30/37	[-]	1,22																	
	C40/50	[-]	1,41																	
	C50/60	[-]	1,55																	
Concrete cone and splitting failure																				
HSL-3, HSL-3-G, HSL-3-B, HSL-3-SH, HSL-3-SK																				
Installation safety factor	γ_2[1] = γ_{inst}[2]	[-]	1,2			1,0														
HSL-3-R, HSL-3-GR, HSL-3-SKR																				
Installation safety factor	γ_2[1] = γ_{inst}[2]	[-]	1,0															-		
Factor	$k_{ucr,N}$[2]	[-]	10,1																	
	$k_{cr,N}$[2]	[-]	7,2																	
Spacing	$s_{cr,N}$	[mm]	$3 \cdot h_{ef}$																	
Edge distance	$c_{cr,N}$	[mm]	$1{,}5 \cdot h_{ef}$																	
HSL-3, HSL-3-G, HSL-3-B, HSL-3-SH, HSL-3-SK																				
Spacing (splitting)	$s_{cr,sp}$	[mm]	230	320	400	270	360	550	300	420	520	380	570	680	480	710	850	570	900	1050
Edge distance (splitting)	$c_{cr,sp}$	[mm]	115	160	200	135	180	275	150	210	260	190	285	340	240	355	425	285	450	525
HSL-3-R, HSL-3-GR, HSL-3-SKR																				
Spacing (splitting)	$s_{cr,sp}$	[mm]	340	350	350	440	540	660	530	530	500	480	570	660	670	880	1110	-	-	-
Edge distance (splitting)	$c_{cr,sp}$	[mm]	170	175	175	220	270	330	265	265	250	240	285	330	335	440	555	-	-	-

[1] Parameter according to ETAG001 Annex C
[2] Parameter according to CEN/TS 1992-4:2009
[3] Pull-out failure is not decisive for design.

Hilti heavy duty anchor HSL-3(-R)

Annex C2

Performances
Characteristic resistance under tension load
Design according to CEN/TS 1992-4:2009 or ETAG001, Annex C

Table C2: Characteristic values of resistance under shear load in case of static and quasi-static loading HSL-3(-R), HSL-3-G(-GR), HSL-3-B, HSL-3-SH, HSL-3-SK(-SKR)

Size			**M8**			**M10**			**M12**			**M16**			**M20**			**M24**		
Setting position			①	②	③	①	②	③	①	②	③	①	②	③	①	②	③	①	②	③
Effective anchorage depth	h_{ef}	[mm]	60	80	100	70	90	110	80	105	130	100	125	150	125	155	185	150	180	210
Steel failure without lever arm																				
HSL-3, HSL-3-G, HSL-3-B, HSL-3-SH, HSL-3-SK																				
Partial safety factor	$\gamma_{Ms,V}$	[-]	1,25																	
Ductility factor	k_2 [1)]	[-]	1,0																	
HSL-3-GR																				
Partial safety factor	$\gamma_{Ms,V}$	[-]	1,25															-		
Ductility factor	k_2 [1)]	[-]	1,0															-		
HSL-3-R, HSL-3-SKR																				
Partial safety factor	$\gamma_{Ms,V}$	[-]	1,25			1,56												-		
Ductility factor	k_2 [1)]	[-]	1,0															-		
HSL-3, HSL-3-B																				
Characteristic resistance	$V_{Rk,s}$	[kN]	31,1			60,5			89,6			158,5			186,0			204,5		
HSL-3-SH, HSL-3-SK																				
Characteristic resistance	$V_{Rk,s}$	[kN]	31,1			60,5			89,6			-			-			-		
HSL-3-G																				
Characteristic resistance	$V_{Rk,s}$	[kN]	26,1			41,8			59,3			120,6			155,3			204,5		
Threaded rod only																				
Characteristic resistance	$V_{Rk,s}$	[kN]	14,6			23,2			33,7			62,8			98,0			146,5		
HSL-3-GR																				
Characteristic resistance	$V_{Rk,s}$	[kN]	40,3			58,9			78,7			129,5			151,9			-		
HSL-3-R, HSL-3-SKR																				
Characteristic resistance	$V_{Rk,s}$	[kN]	50,9			63,9			82,8			127,7			154,8			-		

Table C2: Continued

Size			**M8**			**M10**			**M12**			**M16**			**M20**			**M24**		
Setting position			①	②	③	①	②	③	①	②	③	①	②	③	①	②	③	①	②	③
Effective anchorage depth	h_{ef}	[mm]	60	80	100	70	90	110	80	105	130	100	125	150	125	155	185	150	180	210
Steel failure with lever arm																				
HSL-3, HSL-3-G, HSL-3-B, HSL-3-SH, HSL-3-SK																				
Partial safety factor	$\gamma_{Ms,V}$	[-]	1,25																	
Ductility factor	k_2[1)]	[-]	1,0																	
Characteristic resistance	$M^0_{Rk,s}$	[Nm]	30			60			105			266			519			898		
HSL-3-GR																				
Partial safety factor	$\gamma_{Ms,V}$	[-]	1,25															-		
Ductility factor	k_2[1)]	[-]	1,0															-		
HSL-3-R, HSL-3-SKR																				
Partial safety factor	$\gamma_{Ms,V}$	[-]	1,25			1,56												-		
Ductility factor	k_2[1)]	[-]	1,0															-		
Characteristic resistance	$M^0_{Rk,s}$	[Nm]	26.2			52.3			91.7			233.1			454.4			-		
Concrete pryout failure																				
HSL-3, HSL-3-G, HSL-3-B, HSL-3-SH, HSL-3-SK																				
Pry-out factor	$k^{2)} = k_3$[1)]	[-]	1,8	2,0	2,0	2,0														
Installation safety factor	γ_2[2)] = γ_{inst}[1)]	[-]	1,0																	
HSL-3-R, HSL-3-GR, HSL-3-SKR																				
Pry-out factor	$k^{2)} = k_3$[1)]	[-]	2,0																	
Installation safety factor	γ_2[2)] = γ_{inst}[1)]	[-]	1,0																	
Concrete edge failure																				
Effective length of anchor	$l_f = h_{ef}$	[mm]	60	80	100	70	90	110	80	105	130	100	125	150	125	155	185	150	180	210
Diameter of anchor	d_{nom}	[mm]	12			15			18			24			28			32		
Installation safety factor	γ_2[2)] = γ_{inst}[1)]	[-]	1,0																	

[1)] Parameter according to CEN/TS 1992-4:2009.
[2)] Parameter according to ETAG001, Annex C.

Hilti heavy duty anchor HSL-3(-R)

Annex C4

Performances
Characteristic resistance under shear load
Design according to CEN/TS 1992-4:2009 or ETAG001, Annex C

Table C3: Displacements under tension load in case of static and quasi-static loading - HSL-3(-R), HSL-3-G(-GR), HSL-3-B, HSL-3-SH, HSL-3-SK(-SKR)

Size			**M8**	**M10**	**M12**	**M16**	**M20**	**M24**
HSL-3, HSL-3-G, HSL-3-B, HSL-3-SH, HSL-3-SK								
Tension load in non-cracked concrete	N	[kN]	9,3	11,7	14,3	20,0	27,9	36,7
Corresponding displacement	δ_{N0}	[mm]	0,1	0,1	0,2	0,3	0,4	0,5
	$\delta_{N\infty}$	[mm]	0,2	0,2	0,2	0,4	0,4	0,6
Tension load in cracked concrete	N	[kN]	3,6	6,4	10,2	14,3	20,0	26,2
Corresponding displacement	δ_{N0}	[mm]	0,5	0,5	0,6	0,6	0,7	0,8
	$\delta_{N\infty}$	[mm]	1,1	1,1	1,1	1,1	1,1	1,1
HSL-3-R, HSL-3-GR, HSL-3-SKR								
Tension load in non-cracked concrete	N	[kN]	9,5	13,3	17,1	23,8	33,3	-
Corresponding displacement	δ_{N0}	[mm]	0,15	0,48	0,41	0,22	0,33	-
	$\delta_{N\infty}$	[mm]	0,51	0,51	0,51	0,51	0,51	-
Tension load in cracked concrete	N	[kN]	5,7	7,6	11,4	17,1	23,8	-
Corresponding displacement	δ_{N0}	[mm]	1,17	0,75	2,42	6,37	2,99	-
	$\delta_{N\infty}$	[mm]	1,35	0,94	1,66	1,33	1,27	-

Table C4: Displacements under shear load in case of static and quasi-static loading - HSL-3, HSL-3-G, HSL-3-B, HSL-3-SH, HSL-3-SK

Size			**M8**	**M10**	**M12**	**M16**	**M20**	**M24**
HSL-3, HSL-3-B, HSL-3-SH, HSL-3-SK								
Shear load in cracked and non-cracked concrete	V	[kN]	17,8	34,6	51,2	90,6	106,3	116,9
Corresponding displacement	δ_{v0}	[mm]	3,8	5,2	6,3	8,5	7,3	9,5
	$\delta_{v\infty}$	[mm]	5,7	7,8	9,4	12,7	11,0	14,3
HSL-3-G								
Shear load in cracked and non-cracked concrete	V	[kN]	8,6	23,9	33,9	68,9	88,7	116,9
Corresponding displacement	δ_{v0}	[mm]	3,7	5,0	6,0	7,9	7,8	9,5
	$\delta_{v\infty}$	[mm]	5,6	7,4	9,0	11,9	11,8	14,3

Table C5: Displacements under shear load in case of static and quasi-static loading - HSL-3-R, HSL-3-GR, HSL-3-SKR

Size			**M8**	**M10**	**M12**	**M16**	**M20**	**M24**
HSL-3-R, HSL-3-GR, HSL-3-SKR								
Shear load in cracked and non-cracked concrete	V	[kN]	19,2	28,0	45,0	74,0	72,3	-
Corresponding displacement	δ_{v0}	[mm]	12,26	8,13	7,47	41,11	12,44	-
	$\delta_{v\infty}$	[mm]	18,4	12,2	11,2	61,7	18,7	-

Table C6: Characteristic values of resistance under tension load in case of seismic category C1 - HSL-3(-R), HSL-3-G(-GR), HSL-3-B, HSL-3-SH, HSL-3-SK(SKR)

Size			**M8**			**M10**			**M12**			**M16**			**M20**			**M24**		
Setting position			①	②	③	①	②	③	①	②	③	①	②	③	①	②	③	①	②	③
Effective anchorage depth	h_{ef}	[mm]	60	80	100	70	90	110	80	105	130	100	125	150	125	155	185	150	180	210
Steel failure																				
HSL-3, HSL-3-G, HSL-3-B, HSL-3-SH, HSL-3-SK																				
Partial safety factor	$\gamma_{Ms,seis}$[1)]	[-]	1,5																	
HSL-3-GR																				
Partial safety factor	$\gamma_{Ms,N}$	[-]	1,5															-		
HSL-3-R, HSL-3-SKR																				
Partial safety factor	$\gamma_{Ms,N}$	[-]	1,5			1,87												-		
HSL-3, HSL-3-G, HSL-3-B, HSL-3-SH, HSL-3-SK																				
Characteristic resistance	$N_{Rk,s,seis}$	[kN]	29,3			46,4			67,4			125,6			196,0			282,4		
HSL-3-R, HSL-3-GR, HSL-3-SKR																				
Characteristic resistance	$N_{Rk,s,seis}$	[kN]	25,6			40,6			59,0			109,9			171,5			-		
Pullout failure																				
HSL-3, HSL-3-G, HSL-3-B, HSL-3-SH, HSL-3-SK																				
Installation safety factor	γ_2[2)] = γ_{inst}[3)]	[-]	1,2			1,0														
HSL-3-R, HSL-3-GR, HSL-3-SKR																				
Installation safety factor	γ_2[1)] = γ_{inst}[2)]	[-]	1,0															-		
HSL-3, HSL-3-G, HSL-3-B, HSL-3-SH, HSL-3-SK																				
Characteristic resistance	$N_{Rk,p,seis}$	[kN]	12	12	12	16	16	16	-[4)]	24	24	-[4)]	36	36	-[4)]	50	50	-[4)]	65	65
HSL-3-R, HSL-3-GR, HSL-3-SKR																				
Characteristic resistance	$N_{Rk,p,seis}$	[kN]	12	12	12	16	16	16	-[4)]	24	24	-[4)]	36	36	-[4)]	50	50	-	-	-

[1)] In absence of other national regulations
[2)] Parameter according to TR045
[3)] Parameter according to CEN/TS 1992-4:2009
[4)] Pull-out failure is not decisive for design.

Table C6: Continued

Size			**M8**			**M10**			**M12**			**M16**			**M20**			**M24**		
Setting position			①	②	③	①	②	③	①	②	③	①	②	③	①	②	③	①	②	③
Effective anchorage depth	h_{ef}	[mm]	60	80	100	70	90	110	80	105	130	100	125	150	125	155	185	150	180	210
Concrete cone failure																				
HSL-3, HSL-3-G, HSL-3-B, HSL-3-SH, HSL-3-SK																				
Installation safety factor	γ_2[2] = γ_{inst}[3]	[-]	1,2			1,0														
HSL-3-R, HSL-3-GR, HSL-3-SKR																				
Installation safety factor	γ_2[1] = γ_{inst}[2]	[-]	1,0															-		

[1] In absence of other national regulations
[2] Parameter according to TR045
[3] Parameter according to CEN/TS 1992-4:2009
[4] Pull-out failure is not decisive for design.

Table C7: Characteristic values of resistance under shear load in case of seismic category C1 - HSL-3(-R), HSL-3-G(-GR), HSL-3-B, HSL-3-SH, HSL-3-SK(-SKR)

Size			**M8**			**M10**			**M12**			**M16**			**M20**			**M24**		
Setting position			①	②	③	①	②	③	①	②	③	①	②	③	①	②	③	①	②	③
Effective anchorage depth	h_{ef}	[mm]	60	80	100	70	90	110	80	105	130	100	125	150	125	155	185	150	180	210
Steel failure without lever arm																				
HSL-3, HSL-3-G, HSL-3-B, HSL-3-SH, HSL-3-SK																				
Partial safety factor	$\gamma_{Ms,seis}$[1)]	[-]	1,25																	
HSL-3-GR																				
Partial safety factor	$\gamma_{Ms,seis}$[1)]	[-]	1,25																	
HSL-3-R, HSL-3-SKR																				
Partial safety factor	$\gamma_{Ms,seis}$[1)]	[-]	1,25			1,56												-		
HSL-3, HSL-3-B																				
Characteristic resistance	$V_{Rk,s,seis}$	[kN]	17,7			44,2			58,2			114,1			109,7			163,6		
HSL-3-SH, HSL-3-SK																				
Characteristic resistance	$V_{Rk,s,seis}$	[kN]	17,7			44,2			58,2			-			-			-		
HSL-3-G																				
Characteristic resistance	$V_{Rk,s,seis}$	[kN]	14,9			30,5			38,5			86,8			91,6			-		
HSL-3-R, HSL-3-GR, HSL-3-SKR																				
Characteristic resistance	$V_{Rk,s,seis}$	[kN]	10,4			25,8			28			59,2			59,2			-		
Concrete pryout failure																				
Installation safety factor	γ_2[2)] = γ_{inst}[3)]	[-]	1,0																	
Concrete edge failure																				
Installation safety factor	γ_2[2)] = γ_{inst}[3)]	[-]	1,0																	

[1)] In absence of other national regulations
[2)] Parameter according to TR045
[3)] Parameter according to CEN/TS 1992-4:2009

Table C8: Displacements under tension load in case of seismic category C1 - HSL-3, HSL-3-G, HSL-3-B, HSL-3-SH, HSL-3-SK

Size			**M8**	**M10**	**M12**	**M16**	**M20**	**M24**
HSL-3, HSL-3-G, HSL-3-B, HSL-3-SH, HSL-3-SK								
Displacement	$\delta_{N,seis}$	[mm]	2,17	1,93	2,12	1,95	3,80	2,69

Table C9: Displacements under shear load in case of seismic category C1 - HSL-3, HSL-3-G, HSL-3-B, HSL-3-SH, HSL-3-SK

Size			**M8**	**M10**	**M12**	**M16**	**M20**	**M24**
HSL-3, HSL-3-B, HSL-3-SH, HSL-3-SK								
Displacement	$\delta_{V,seis}$	[mm]	4,61	4,47	5,18	5,70	4,23	5,95
HSL-3-G								
Displacement	$\delta_{V,seis}$	[mm]	4,61	4,47	5,18	5,70	4,23	-

Table C10: Characteristic values of resistance under tension load in case of seismic category C2 - HSL-3, HSL-3-G, HSL-3-B, HSL-3-SH, HSL-3-SK

Size			**M10**			**M12**			**M16**			**M20**		
Setting position			①	②	③	①	②	③	①	②	③	①	②	③
Effective anchorage depth	h_{ef}	[mm]	70	90	110	80	105	130	100	125	150	125	155	185
Steel failure														
Partial safety factor	$\gamma_{Ms,seis}$ [1)]	[-]	1,5											
Characteristic resistance	$N_{Rk,s,seis}$	[kN]	46,4			67,4			125,6			196,0		
Pullout failure														
Installation safety factor	γ_2 [2)] = γ_{inst} [3)]	[-]	1,0											
Characteristic resistance	$N_{Rk,p,seis}$	[kN]	12,2	12,2	12,2	-[4)]	25,8	25,8	34,2	34,2	34,2	40,1	40,1	40,1
Concrete cone failure														
Installation safety factor	γ_2 [2)] = γ_{inst} [3)]	[-]	1,0											

[1)] In absence of other national regulations
[2)] Parameter according to TR045
[3)] Parameter according to CEN/TS 1992-4:2009
[4)] Pull-out failure is not decisive for design.

Table C11: Characteristic values of resistance under shear load in case of seismic category C2 - HSL-3, HSL-3-G, HSL-3-B, HSL-3-SH, HSL-3-SK

Size			**M10**			**M12**			**M16**			**M20**		
Setting position			①	②	③	①	②	③	①	②	③	①	②	③
Effective anchorage depth	h_{ef}	[mm]	70	90	110	80	105	130	100	125	150	125	155	185
Steel failure without lever arm														
Partial safety factor	$\gamma_{Ms,seis}$[1)]	[-]	1,25											
HSL-3, HSL-3-B														
Characteristic resistance	$V_{Rk,s,seis}$	[kN]	18,8			26,3			50,7			78,1		
HSL-3-SH, HSL-3-SK														
Characteristic resistance	$V_{Rk,s,seis}$	[kN]	18,8			26,3			-			-		
HSL-3-G														
Characteristic resistance	$V_{Rk,s,seis}$	[kN]	18,0			22,5			44,6			50,2		
Concrete pryout failure														
Installation safety factor	γ_2[2)] = γ_{inst}[3)]	[-]	1,0											
Concrete edge failure														
Installation safety factor	γ_2[2)] = γ_{inst}[3)]	[-]	1,0											

[1)] In absence of other national regulations
[2)] Parameter according to TR045
[3)] Parameter according to CEN/TS 1992-4:2009
[4)] Pull-out failure is not decisive for design.

Table C12: Displacements under tension load in case of seismic category C2 - HSL-3, HSL-3-G, HSL-3-B, HSL-3-SH, HSL-3-SK

Size			**M10**	**M12**	**M16**	**M20**
Displacement DLS	$\delta_{N,seis(DLS)}$	[mm]	3,63	5,27	5,42	3,95
Displacement ULS	$\delta_{N,seis(ULS)}$	[mm]	13,09	14,68	16,02	12,25

Table C13: Displacements under shear load in case of seismic category C2 - HSL-3, HSL-3-B, HSL-3-SH, HSL-3-SK

Size			**M10**	**M12**	**M16**	**M20**
Displacement DLS	$\delta_{V,seis(DLS)}$	[mm]	5,61	5,79	6,32	6,29
Displacement ULS	$\delta_{V,seis(ULS)}$	[mm]	9,03	10,66	14,38	14,16

Table C14: Displacements under shear load in case of seismic category C2 - HSL-3-G

Size			**M10**	**M12**	**M16**	**M20**
Displacement DLS	$\delta_{V,seis(DLS)}$	[mm]	5,86	5,68	5,58	5,88
Displacement ULS	$\delta_{V,seis(ULS)}$	[mm]	9,94	10,17	9,08	9,70

Table C15: Characteristic tension resistance under fire exposure for Hilti metal expansion anchor HSL-3(-R), HSL-3-G(-GR), HSL-3-B, HSL-3-SH, HSL-3-SK(-SKR) in cracked and non-cracked concrete

Size			**M8**			**M10**			**M12**			**M16**			**M20**			**M24**		
Setting position			①	②	③	①	②	③	①	②	③	①	②	③	①	②	③	①	②	③
Effective anchorage depth	h_{ef}	[mm]	60	80	100	70	90	110	80	105	130	100	125	150	125	155	185	150	180	210
Steel failure																				
HSL-3, HSL-3-G, HSL-3-B, HSL-3-SH, HSL-3-SK																				
Characteristic resistance	R30	$N_{Rk,s,fi}$ [kN]	0,37			0,87			1,69			3,14			4,90			7,06		
	R60	$N_{Rk,s,fi}$ [kN]	0,33			0,75			1,26			2,36			3,68			5,30		
	R90	$N_{Rk,s,fi}$ [kN]	0,26			0,58			1,10			2,04			3,19			4,59		
	R120	$N_{Rk,s,fi}$ [kN]	0,18			0,46			0,84			1,57			2,45			3,53		
HSL-3-R, HSL-3-GR, HSL-3-SKR																				
Characteristic resistance	R30	$N_{Rk,s,fi}$ [kN]	0,7			1,5			2,5			4,7			7,4			-		
	R60	$N_{Rk,s,fi}$ [kN]	0,59			1,2			2,1			3,9			6,1			-		
	R90	$N_{Rk,s,fi}$ [kN]	0,44			0,9			1,7			3,1			4,9			-		
	R120	$N_{Rk,s,fi}$ [kN]	0,37			0,8			1,3			2,5			3,9			-		
Pullout failure																				
HSL-3, HSL-3-G, HSL-3-B, HSL-3-SH, HSL-3-SK																				
Characteristic resistance ≥C20/25	R30	$N_{Rk,p,fi}$ [kN]																		
	R60	$N_{Rk,p,fi}$ [kN]																		
	R90	$N_{Rk,p,fi}$ [kN]	3,0			4,0			-[1]	6,0		-[1]	9,0		-[1]	12,5		-[1]	16,3	
	R120	$N_{Rk,p,fi}$ [kN]	2,4			3,2			-[1]	4,8		-[1]	7,2		-[1]	10,0		-[1]	13,0	
HSL-3-R, HSL-3-GR, HSL-3-SKR																				
Characteristic resistance ≥C20/25	R30	$N_{Rk,p,fi}$ [kN]																		
	R60	$N_{Rk,p,fi}$ [kN]																		
	R90	$N_{Rk,p,fi}$ [kN]	3,0			4,0			-[1]	6,0		-[1]	9,0		-[1]	12,5		-		
	R120	$N_{Rk,p,fi}$ [kN]	2,4			3,2			-[1]	4,8		-[1]	7,2		-[1]	10,0		-		

[1] Pull-out failure is not decisive for design.

[2] In absence of other national regulations the partial safety factor for resistance under fire exposure $\gamma_{M,fi} = 1,0$ is recommended.

Table C15: Continued

Size			**M8**			**M10**			**M12**		
Setting position			①	②	③	①	②	③	①	②	③
Effective anchorage depth	h_{ef}	[mm]	60	80	100	70	90	110	80	105	130
Concrete cone failure and splitting failure											
HSL-3, HSL-3-G, HSL-3-B, HSL-3-SH, HSL-3-SK											
Characteristic resistance ≥C20/25	R30	$N_{Rk,c,fi}$ [kN]									
	R60	$N_{Rk,c,fi}$ [kN]									
	R90	$N_{Rk,c,fi}$ [kN]	5,0	10,3	18,0	7,40	15,8	28,4	10,3	20,3	34,7
	R120	$N_{Rk,c,fi}$ [kN]	4,0	8,2	14,4	5,90	12,7	22,7	8,2	16,3	27,7
HSL-3-R, HSL-3-GR, HSL-3-SKR											
Characteristic resistance ≥C20/25	R30	$N_{Rk,c,fi}$ [kN]									
	R60	$N_{Rk,c,fi}$ [kN]									
	R90	$N_{Rk,c,fi}$ [kN]	5,0	10,3	18,0	7,40	15,8	28,4	10,3	20,3	34,7
	R120	$N_{Rk,c,fi}$ [kN]	4,0	8,2	14,4	5,90	12,7	22,7	8,2	16,3	27,7
Spacing		$s_{cr,N}$ [mm]	240	320	400	280	380	480	320	420	520
Edge distance		$c_{cr,N}$ [mm]	120	160	200	140	190	240	160	210	260

Size			**M16**			**M20**			**M24**		
Setting position			①	②	③	①	②	③	①	②	③
Effective anchorage depth	h_{ef}	[mm]	100	125	150	125	155	185	150	180	210
Concrete cone failure and splitting failure											
HSL-3, HSL-3-G, HSL-3-B, HSL-3-SH, HSL-3-SK											
Characteristic resistance ≥C20/25	R30	$N_{Rk,c,fi}$ [kN]									
	R60	$N_{Rk,c,fi}$ [kN]									
	R90	$N_{Rk,c,fi}$ [kN]	18,0	31,4	49,6	31,4	53,8	83,8	49,6	78,2	109,6
	R120	$N_{Rk,c,fi}$ [kN]	14,4	25,2	39,7	25,2	43,1	67,0	39,7	62,6	87,6
HSL-3-R, HSL-3-GR, HSL-3-SKR											
Characteristic resistance ≥C20/25	R30	$N_{Rk,c,fi}$ [kN]									
	R60	$N_{Rk,c,fi}$ [kN]									
	R90	$N_{Rk,c,fi}$ [kN]	18,0	31,4	49,6	31,4	53,8	83,8	-		
	R120	$N_{Rk,c,fi}$ [kN]	14,4	25,2	39,7	25,2	43,1	67,0	-		
Spacing		$s_{cr,N}$ [mm]	400	500	600	500	620	740	600	720	840
Edge distance		$c_{cr,N}$ [mm]	200	250	300	250	310	370	300	360	420

In absence of other national regulations the partial safety factor for resistance under fire exposure $\gamma_{M,fi}$ = 1,0 is recommended.

Hilti heavy duty anchor HSL-3(-R)

Annex C15

Performances
Characteristic resistance of tension load resistance under fire resistance

Table C16: Characteristic shear resistance under fire exposure for Hilti metal expansion anchor HSL-3(-R), HSL-3-G(-GR), HSL-3-B, HSL-3-SH, HSL-3-SK(-SKR) in cracked and non-cracked concrete

Size			**M8**			**M10**			**M12**			**M16**			**M20**			**M24**		
Setting position			①	②	③	①	②	③	①	②	③	①	②	③	①	②	③	①	②	③
Effective anchorage depth	h_{ef}	[mm]	60	80	100	70	90	110	80	105	130	100	125	150	125	155	185	150	180	210
Steel failure without lever arm																				
HSL-3, HSL-3-G, HSL-3-B, HSL-3-SH, HSL-3-SK																				
Characteristic resistance	R30	$V_{Rk,s,fi}$ [kN]	0,37			0,87			1,69			3,14			4,90			7,06		
	R60	$V_{Rk,s,fi}$ [kN]	0,33			0,75			1,26			2,36			3,68			5,30		
	R90	$V_{Rk,s,fi}$ [kN]	0,26			0,58			1,10			2,04			3,19			4,59		
	R120	$V_{Rk,s,fi}$ [kN]	0,18			0,46			0,84			1,57			2,45			3,53		
HSL-3-R, HSL-3-GR, HSL-3-SKR																				
Characteristic resistance	R30	$V_{Rk,s,fi}$ [kN]	0,7			1,5			2,5			4,7			7,4			-		
	R60	$V_{Rk,s,fi}$ [kN]	0,59			1,2			2,1			3,9			6,1			-		
	R90	$V_{Rk,s,fi}$ [kN]	0,44			0,9			1,7			3,1			4,9			-		
	R120	$V_{Rk,s,fi}$ [kN]	0,37			0,8			1,3			2,5			3,9			-		
Steel failure with lever arm																				
HSL-3, HSL-3-G, HSL-3-B, HSL-3-SH, HSL-3-SK																				
Characteristic resistance	R30	$M^0_{Rk,s,fi}$ [Nm]	374,8			1121,5			2620,1			6659,3			12981,5			22451,1		
	R60	$M^0_{Rk,s,fi}$ [Nm]	337,3			971,9			1965,1			4994,4			9736,1			16838,4		
	R90	$M^0_{Rk,s,fi}$ [Nm]	262,3			747,6			1703,1			4328,5			8438,0			14593,2		
	R120	$M^0_{Rk,s,fi}$ [Nm]	187,4			598,1			1310,1			3329,6			6490,8			11225,6		
HSL-3-R, HSL-3-GR, HSL-3-SKR																				
Characteristic resistance	R30	$M^0_{Rk,s,fi}$ [Nm]	749,6			1869,1			3930,2			9988,9			19472,3			-		
	R60	$M^0_{Rk,s,fi}$ [Nm]	599,6			1495,3			3275,1			8324,1			16226,9			-		
	R90	$M^0_{Rk,s,fi}$ [Nm]	449,7			1196,2			2620,1			6659,3			12981,5			-		
	R120	$M^0_{Rk,s,fi}$ [Nm]	374,8			1046,7			2096,1			5327,4			10385,2			-		

In absence of other national regulations the partial safety factor for resistance under fire exposure $\gamma_{M,fi}$ = 1,0 is recommended.

Table C16: Continued

Size			**M8**			**M10**			**M12**		
Setting position			①	②	③	①	②	③	①	②	③
Effective anchorage depth	h_{ef}	[mm]	60	80	100	70	90	110	80	105	130
Concrete pryout failure											
Factor in equation (5.6) of ETAG 001 Annex C, 5.2.3.3	k	[-]	2,0								
HSL-3, HSL-3-G, HSL-3-B, HSL-3-SH, HSL-3-SK											
Characteristic resistance ≥C20/25	R30	$V_{Rk,cp,fi}$[kN]									
	R60	$V_{Rk,cp,fi}$[kN]									
	R90	$V_{Rk,cp,fi}$[kN]	10,0	20,6	36,0	14,8	31,7	56,8	20,6	40,7	69,4
	R120	$V_{Rk,cp,fi}$[kN]	8,00	16,5	28,8	11,8	25,3	45,4	16,5	32,5	55,5
HSL-3-R, HSL-3-GR, HSL-3-SKR											
Characteristic resistance ≥C20/25	R30	$V_{Rk,cp,fi}$[kN]									
	R60	$V_{Rk,cp,fi}$[kN]									
	R90	$V_{Rk,cp,fi}$[kN]	10,0	20,6	36,0	14,8	31,7	56,8	20,6	40,7	69,4
	R120	$V_{Rk,cp,fi}$[kN]	8,00	16,5	28,8	11,8	25,3	45,4	16,5	32,5	55,5
Concrete edge failure											

The initial value $V^0_{Rk,c,fi}$ of the characteristic resistance in concrete C20/25 to C50/60 under fire exposure may be determined by:

$V^0_{Rk,c,fi} = 0,25 \times V^0_{Rk,c}$ (≤ R90) $V^0_{Rk,c,fi} = 0,20 \times V^0_{Rk,c}$ (R120)

with $V^0_{Rk,c,fi}$ initial value of the characteristic resistance in cracked concrete C20/25 under normal temperature.

In absence of other national regulations the partial safety factor for resistance under fire exposure γ M,fi = 1,0 is recommended.

Table C16: Continued

Size			**M16**			**M20**			**M24**		
Setting position			①	②	③	①	②	③	①	②	③
Effective anchorage depth	h_{ef}	[mm]	100	125	150	125	155	185	150	180	210
Concrete pryout failure											
Factor in equation (5.6) of ETAG 001 Annex C, 5.2.3.3	k	[-]	2,0								
HSL-3, HSL-3-G, HSL-3-B, HSL-3-SH, HSL-3-SK											
Characteristic resistance ≥C20/25	R30	$V_{Rk,cp,fi}$[kN]									
	R60	$V_{Rk,cp,fi}$[kN]									
	R90	$V_{Rk,cp,fi}$[kN]	36,0	62,9	99,2	62,9	107,7	167,6	99,2	156,5	219,1
	R120	$V_{Rk,cp,fi}$[kN]	28,8	50,3	79,4	50,3	86,1	134,1	79,4	125,2	175,3
HSL-3-R, HSL-3-GR, HSL-3-SKR											
Characteristic resistance ≥C20/25	R30	$V_{Rk,cp,fi}$[kN]									
	R60	$V_{Rk,cp,fi}$[kN]									
	R90	$V_{Rk,cp,fi}$[kN]	36,0	62,9	99,2	62,9	107,7	167,6	-	-	-
	R120	$V_{Rk,cp,fi}$[kN]	28,8	50,3	79,4	50,3	86,1	134,1	-	-	-
Concrete edge failure											

The initial value $V^0_{Rk,c,fi}$ of the characteristic resistance in concrete C20/25 to C50/60 under fire exposure may be determined by:

$V^0_{Rk,c,fi} = 0{,}25 \times V^0_{Rk,c}$ (≤ R90) $V^0_{Rk,c,fi} = 0{,}20 \times V^0_{Rk,c}$ (R120)

with $V^0_{Rk,c,fi}$ initial value of the characteristic resistance in cracked concrete C20/25 under normal temperature.

In absence of other national regulations the partial safety factor for resistance under fire exposure $\gamma_{M,fi} = 1{,}0$ is recommended.