



Designated according to The Construction Products (Amendment etc.) (EU Exit) Regulations 2020

UK Technical Assessment	UKTA-0836-23/6697 of 17/05/2023
Technical Assessment Body issuing the UK Technical Assessment:	British Board of Agrément
Trade name of the construction product:	Hilti HSL4
Product family to which the construction product belongs:	Torque-controlled expansion anchor, made of galvanized steel, for use in concrete: sizes M8, M10, M12, M16, M20 and M24.
Manufacturer:	Hilti Corporation Feldkircherstrasse 100 FL-9494 Schaan Principality of Liechtenstein
Manufacturing plant(s):	Hilti plants
This UK Technical Assessment contains:	31 pages including 3 Annexes which form an integral part of this assessment.
This UK Technical Assessment is issued in accordance with The Construction Products (Amendment etc.) (EU Exit) Regulations 2020 on the basis of:	UKAD 330232-00-0601 "Mechanical fasteners for use in concrete"

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1. Technical description of the product

The Hilti heavy duty HSL4 anchor is a torque-controlled expansion anchor made of galvanized steel which is placed into a drilled hole and anchored by torque-controlled expansion.

The product description is given in Annex A.

2. Specification of the intended use(s) in accordance with the applicable UK Assessment Document (hereinafter UKAD)

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

The provisions made in this UK Technical Assessment is based on an assumed working life of the anchor of 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.

3. Performance of the product and references to the methods used for its assessment

3.1. Mechanical resistance and stability (BWR 1)

Essential characteristic	Performance
Characteristic resistance in case of static and quasi-static loading, displacements	See Annexes C1 to C5
Characteristic resistance in case of seismic performance category C1, displacements	See Annexes C6 to C8
Characteristic resistance in case of seismic performance category C2, displacements	See Annexes C9 to C11
Durability	See Annex B1

3.2. Safety in case of fire (BWR 2)

Essential characteristic	Performance
Reaction to fire	Anchorage satisfy requirements for Class A1
Resistance to fire	See Annexes C12 to C15

3.3. Health, hygiene and the environment (BWR 3)

Regarding dangerous substances contained in this UK Technical Assessment, there may be requirements applicable to the products falling within its scope (e.g. transposed UK 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.

3.4. Safety and accessibility in use (BWR 4)

For Basic Works Requirement 4: Safety and accessibility in use, the same criteria are valid as for Basic Works Requirement 1: Mechanical resistance and stability.

3.5. Protection against noise (BWR 5)

Not relevant.

3.6. Energy economy and heat retention (BWR 6)

Not relevant.

3.7. Sustainable use of natural resources (BWR 7)

No performance assessed.

3.8. 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.

4. Assessment and verification of constancy of performance (hereinafter AVCP) system applied

4.1. System of assessment and verification of constancy of performance

According to UKAD No. 330232-00-0601 and Annex V of the Construction Products Regulation (Regulation (EU) 305/2011) as brought into UK law and amended, the system of assessment and verification of constancy of performance (AVCP) 1 applies.

5. Technical details necessary for the implementation of the AVCP system, as provided for in the applicable UKAD

Technical details necessary for the implementation of the AVCP system are laid down in the control plan deposited with the British Board of Agrément and made available to the UK Approved Bodies involved in the conformity attestation process.

5.1. UKCA marking for the product/ system must contain the following information:

- Identification number of the Approved Body
- Name/address of the manufacturer of the product/ system
- Marking with intention of clarification of intended use
- Date of marking
- Number of certificate of constancy of performance (where applicable)
- UKTA number.

On behalf of the British Board of Agrément



Date of Issue: 17 May 2023

Hardy Giesler
Chief Executive Officer



British Board of Agrément,
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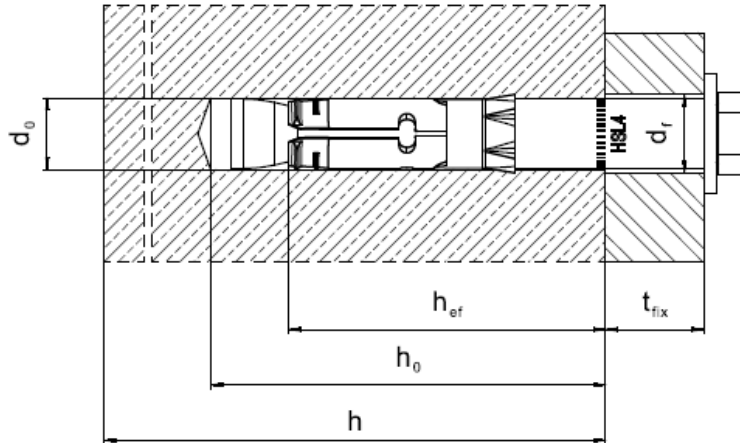
ANNEX A1

Product description

Installed condition and product description

This annex applies to the product described in the main body of the UK Technical Assessment.

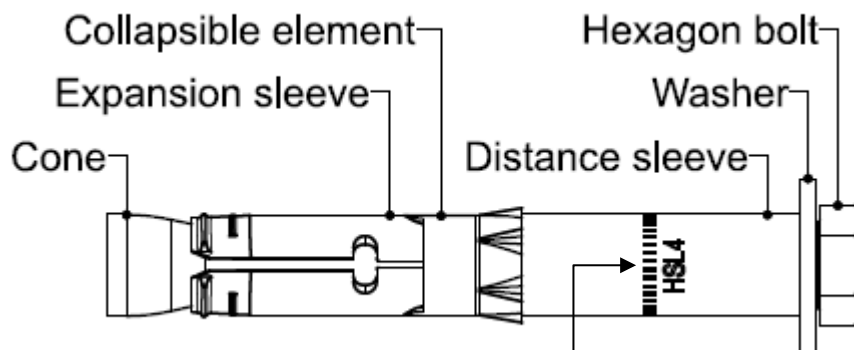
Installed condition



Product description

Figure A1:

Hilti torque-controlled expansion anchor HSL4



Marking:

e.g.

HSL4 M10 40/20/-

Anchor type

Anchor size

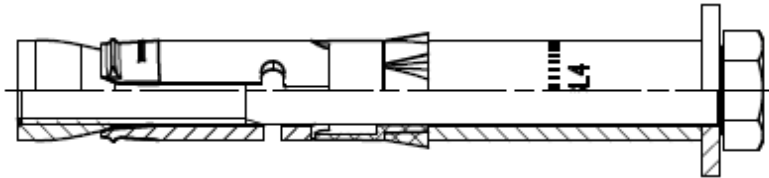
Maximum fixture thickness $t_{fix,1}/t_{fix,2}/t_{fix,3}$

ANNEX A2
Product description
Anchor versions and head configurations

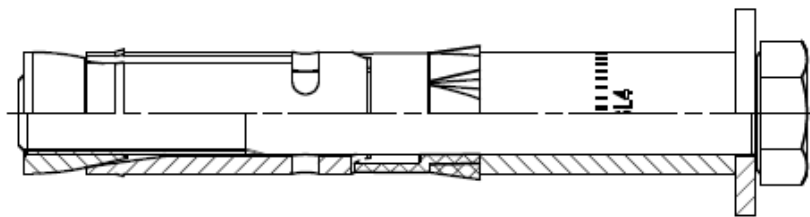
This annex applies to the product described in the main body of the UK Technical Assessment.

Product description

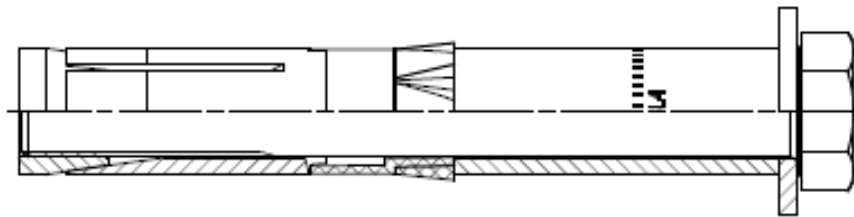
Figure A2:



HSL4...: M8 to M12

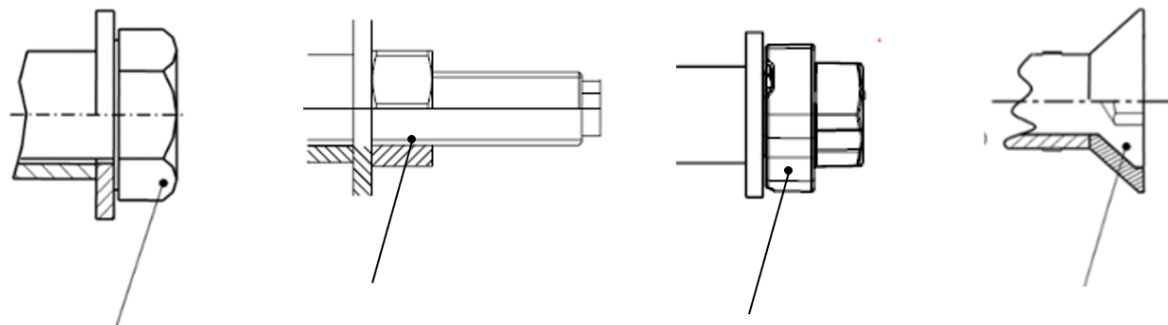


HSL4...: M16



HSL4...: M20 to M24

Figure A3:



**Bolt
version
HSL4
M8-M24**

**Threaded rod
version
HSL4-G
M8-M24**

**Safety cap
version
HSL4-B
M12-M24**

**Countersunk
version
HSL4-SK
M8-M12**

ANNEX A3
Product description
Materials

This annex applies to the product described in the main body of the UK Technical Assessment.

Table A1: Materials Hilti heavy duty anchor HSL4

Designation	Material
HSL4, HSL4-G, HSL4-B, HSL4-SK	
Cone	Carbon steel, electroplated zinc coated $\geq 5\mu\text{m}$
Expansion sleeve	Carbon steel, electroplated zinc coated $\geq 5\mu\text{m}$
Collapsible element	Plastic element
Distance sleeve	Carbon steel, electroplated zinc coated $\geq 5\mu\text{m}$
HSL4	
Washer	Carbon steel, electroplated zinc coated $\geq 5\mu\text{m}$
Hexagonal bolt	Carbon steel, electroplated zinc coated $\geq 5\mu\text{m}$, rupture elongation $\geq 12\%$
HSL4-G	
Hexagon nut	Carbon steel, electroplated zinc coated $\geq 5\mu\text{m}$
Threaded rod	Carbon steel, electroplated zinc coated $\geq 5\mu\text{m}$, rupture elongation $\geq 12\%$
HSL4-B	
Hexagon bolt with safety cap	Carbon steel, electroplated zinc coated $\geq 5\mu\text{m}$, rupture elongation $\geq 12\%$
HSL4-SK	
Cup washer	Carbon steel, electroplated zinc coated $\geq 5\mu\text{m}$
Countersunk bolt	Carbon steel, electroplated zinc coated $\geq 5\mu\text{m}$, rupture elongation $\geq 12\%$

ANNEX B1

Intended use

Specifications

This annex applies to the product described in the main body of the UK Technical Assessment.

Specifications of intended use

Anchorage subject to:

- Static and quasi-static loading: all sizes.
- Seismic performance categories C1 and C2: For sizes, see Table B1.
- Fire exposure: all sizes.

Base materials:

- Reinforced or unreinforced normal weight concrete according to EN 206:2013+A1:2016.
- Strength classes C20/25 to C50/60 according to EN 206:2013+A1:2016.
- Cracked and uncracked concrete.

Use conditions (Environmental conditions):

- HSL4, HSL4-G, HSL4-B, HSL4-SK made of galvanized steel:
Structures subject to dry internal conditions.

Design:

- Anchorage 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 relative to reinforcement or to supports etc.).
- Anchorage under static or quasi-static loading are designed in accordance with EN 1992-4
- Anchorage under seismic actions (cracked concrete) are designed in accordance with EN 1992-4
- Anchorage 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 UK Technical Assessment (UKTA).
- In case of requirements to resistance to fire, local spalling of the concrete cover must be avoided.

Installation:

- Anchor installation is to be carried out by appropriately qualified personnel and under the supervision of the person responsible for technical matters on the site.
- The anchor may only be set once.
- Drilling technique: see Table B1 and Table **B2**.
- Cleaning the hole of drilling dust.
- In the case of an aborted hole, drilling of a 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 the aborted hole.

ANNEX B2
Intended use
Specifications of intended use

This annex applies to the product described in the main body of the UK Technical Assessment.

Table B1: Specifications of intended use

Anchorage subject to:	HSL4	HSL4-G	HSL4-B	HSL4-SK
Static and quasi static loading in cracked and uncracked concrete - Hammer drilling and diamond coring	M8-M24	M8-M24	M12-M24	M8-M12
Seismic performance category C1 - Hammer drilling and diamond coring	M8-M24	M8-M20	M12-M24	M8-M12
Seismic performance category C2 - Hammer drilling only	M10-M24	M10-M24	M12-M24	M10-M12
Fire exposure - Hammer drilling and diamond coring	M8-M24	M8-M24	M12-M24	M8-M12

Table B2: Drilling technique






Anchorage subject to:	HSL4	HSL4-G	HSL4-B	HSL4-SK
Hammer drilling (HD) 	M8-M24	M8-M24	M12-M24	M8-M12
Hammer drilling with Hilti hollow drill bit (HDB) 	M8 M12-M24	M8 M12-M24	M12-M24	M8 M12
Diamond coring (DD): SPX-T core bits (with the DD-30 or DD-EC-1 coring tools) or SPX-H, SPX-L or SPX-L Handheld core bits (with the DD-110 TO DD-250 coring tools) 	M8-M24	M8-M24	M12-M24	M8-M12

Table B3: Methods for application of torque

	HSL4	HSL4-G	HSL4-B	HSL4-SK
Torque wrench 	M8-M24	M8-M24	M12-M24	M8-M12
Machine torquing with Hilti SIW 6AT-A22 impact wrench and SI-AT-A22 ⁽¹⁾ adaptive torque module 	M8-M16	M8-M16	/	/

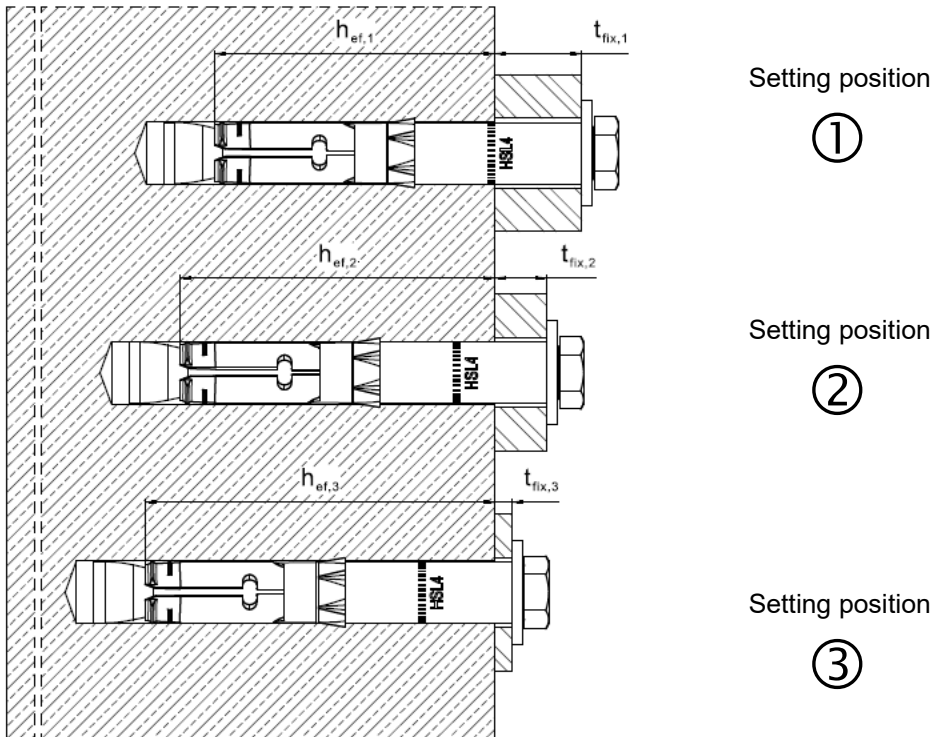
⁽¹⁾ Equivalent combination of Hilti SIW + SI-AT tool, compatible to this anchor type, may be used

ANNEX B3
Intended use
Installation parameters

This annex applies to the product described in the main body of the UK Technical Assessment.

Setting positions for HSL4, HSL4-G, HSL4-B

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



ANNEX B4
Intended use
Installation parameters HSL4

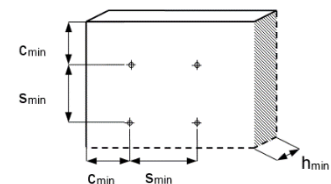
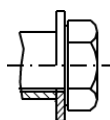
This annex applies to the product described in the main body of the UK Technical Assessment.

Table B4: Installation parameters HSL4

HSL4		M8			M10			M12			M16			M20			M24		
Nominal diameter of drill bit	d_0 [mm]	12			15			18			24			28			32		
Maximum cutting diameter of drill bit	d_{cut} [mm]	12.5			15.5			18.5			24.55			28.55			32.7		
Maximum 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	$t_{fix,1}$ [mm]	5 - 200			5 - 200			5 - 200			10 - 200			10 - 200			10 - 200		
Effective fixture thickness	$t_{fix,i}$	$t_{fix,1}^{(1)} - \Delta_i$																	
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
Minimum 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
Minimum 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]	15			25			60			75			145			210		
Uncracked 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		
Cracked concrete																			
Minimum spacing	s_{min} [mm]	50			70			70			80			120			120		
	$c \geq$ [mm]	80			100			140			180			220			260		
Minimum edge distance	c_{min} [mm]	60			70			70			100			120			120		
	$s \geq$ [mm]	80			120			160			200			220			280		

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

HSL4 Bolt version



ANNEX B5
Intended use
Installation parameters HSL4-G

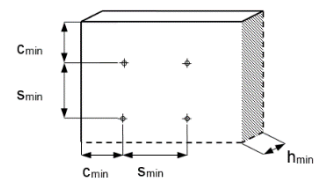
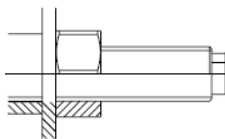
This annex applies to the product described in the main body of the UK Technical Assessment.

Table B5: Installation parameters HSL4-G

HSL4-G		M8			M10			M12			M16			M20			M24		
Nominal diameter of drill bit	d_0 [mm]	12			15			18			24			28			32		
Maximum cutting diameter of drill bit	d_{cut} [mm]	12.5			15.5			18.5			24.55			28.55			32.7		
Maximum 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	$t_{fix,1}$ [mm]	5 - 200			5 - 200			5 - 200			10 - 200			10 - 200			10 - 200		
Effective fixture thickness	$t_{fix,i}$	$t_{fix,1}^{(1)} - \Delta_i$																	
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
Minimum 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
Minimum 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			27			60			70			105			180		
Uncracked 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		
Cracked concrete																			
Minimum spacing	s_{min} [mm]	50			70			70			80			120			120		
	$c \geq$ [mm]	80			100			140			180			220			260		
Minimum edge distance	c_{min} [mm]	60			70			70			100			120			120		
	$s \geq$ [mm]	80			120			160			200			220			280		

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

HSL4-G Threaded rod version



ANNEX B6
Intended use
Installation parameters HSL4-SK

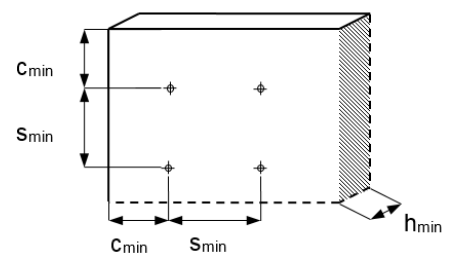
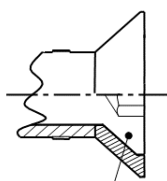
This annex applies to the product described in the main body of the UK Technical Assessment.

Table B6: Installation parameters HSL4-SK

HSL4-SK		M8	M10	M12
Nominal diameter of drill bit	d_0 [mm]	12	15	18
Maximum cutting diameter of drill bit	d_{cut} [mm]	12.5	15.5	18.5
Maximum 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
Minimum fixture thickness	$t_{fix,min}^{(1)}$ [mm]	6	6	8
Effective anchorage depth	h_{ef} [mm]	60	70	80
Minimum 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]	20	32	65
Uncracked 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
Cracked concrete				
Minimum spacing	s_{min} [mm]	50	70	70
	$c \geq$ [mm]	80	100	140
Minimum edge distance	c_{min} [mm]	60	70	70
	$s \geq$ [mm]	80	120	160

⁽¹⁾ The influence of the thickness of fixture to the characteristic resistance for shear loads, steel failure without lever arm is considered.

HSL4-SK Countersunk version



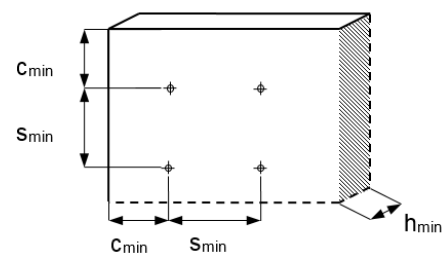
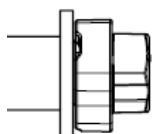
ANNEX B7
Intended use
Installation parameters HSL4-B

This annex applies to the product described in the main body of the UK Technical Assessment.

Table B7: Installation parameters HSL4-B

HSL4-B			M12			M16			M20			M24		
Nominal diameter of drill bit	d_0	[mm]	18			24			28			32		
Maximum cutting diameter of drill bit	d_{cut}	[mm]	18.5			24.55			28.55			32.7		
Maximum 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	$t_{fix,1}$	[mm]	5 - 200			10 - 200			10 - 200			10 - 200		
Effective fixture thickness	$t_{fix,i}$		$t_{fix,1}^{(1)} - \Delta_i$											
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
Minimum depth of drill hole	$h_{1,i}$	[mm]	105	130	155	125	150	175	155	185	215	180	210	240
Minimum 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 is controlled by the safety cap.											
Uncracked 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		
Cracked concrete														
Minimum spacing	s_{min}	[mm]	70			80			120			120		
	$c \geq$	[mm]	140			180			220			260		
Minimum edge distance	c_{min}	[mm]	70			100			120			120		
	$s \geq$	[mm]	160			200			220			280		

HSL4-B Safety cap version



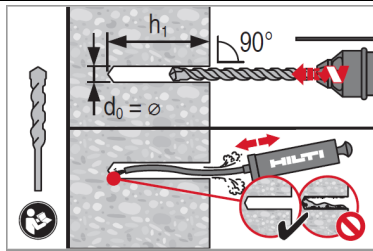
ANNEX B8
Intended use
Installation instruction

This annex applies to the product described in the main body of the UK Technical Assessment.

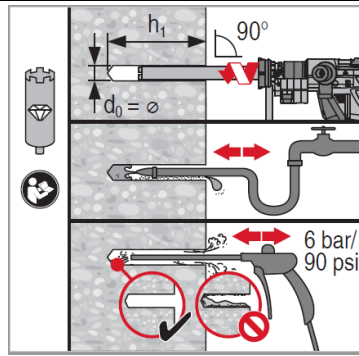
Installation instruction

Hole drilling and cleaning

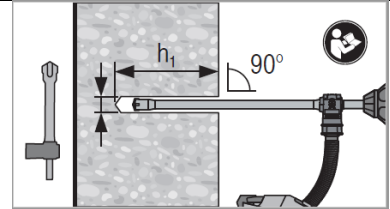
a) Hammer drilling (HD) with manual cleaning (MC):



b) Diamond coring (DD) with flushing and blowing

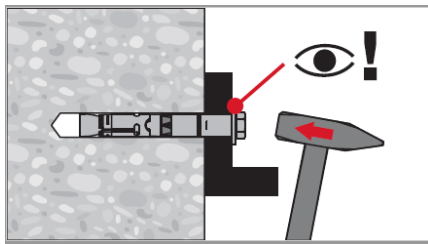


c) Hammer drilling (HD) with hollow drill bit (HDB)



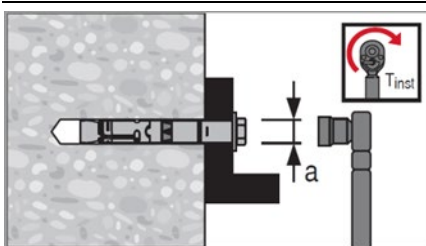
Anchor setting

Hammer setting, check setting

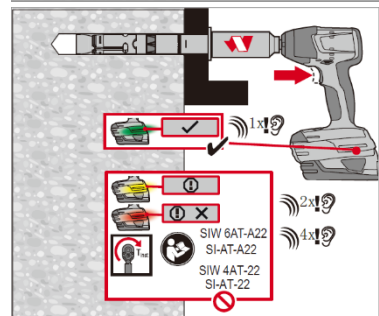
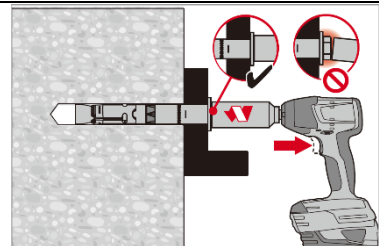
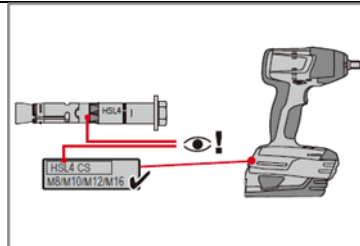


Anchor torquing

a) Use torque wrench



b) Machine torquing: Only HSL4 and HSL4-G M8 to M16



ANNEX C1

Performances

Characteristic resistance under tension load

This annex applies to the product described in the main body of the UK Technical Assessment.

Table C1: Characteristic values of resistance under tension load in case of static and quasi-static loading HSL4, HSL4-G, HSL4-B, HSL4-SK

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																		
HSL4, HSL4-G, HSL4-B, HSL4-SK																		
Partial safety factor $\gamma_{Ms,N}$ [-]	1.5																	
HSL4, HSL4-G, HSL4-B, HSL4-SK																		
Characteristic resistance $N_{Rk,s}$ [kN]	29.3			46.4			67.4			125.6			196.0			282.4		
Pull-out failure																		
Characteristic resistance in concrete C20/25																		
HSL4, HSL4-G, HSL4-B, HSL4-SK																		
Installation safety factor γ_{inst} [-]	1.0																	
HSL4, HSL4-G, HSL4-B, HSL4-SK																		
Non-cracked concrete $N_{Rk,p,uncr}$ [kN]	- ⁽¹⁾	- ⁽¹⁾	- ⁽¹⁾	- ⁽¹⁾	- ⁽¹⁾	- ⁽¹⁾	- ⁽¹⁾	- ⁽¹⁾	- ⁽¹⁾	- ⁽¹⁾	65	65	- ⁽¹⁾	95	95	- ⁽¹⁾	100	100
Cracked concrete $N_{Rk,p,cr}$ [kN]	12	12	12	16	16	16	- ⁽¹⁾	24	24	- ⁽¹⁾	36	36	- ⁽¹⁾	50	50	- ⁽¹⁾	65	65

ANNEX C2

Performances

Characteristic resistance under tension load

This annex applies to the product described in the main body of the UK Technical Assessment.

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
Pull-out failure																			
HSL4, HSL4-G, HSL4-B, HSL4-SK																			
Characteristic resistance in concrete C20/25																			
Increasing factor concrete strength	C30/37 [-]																1.22		
	C40/50 [-]																1.41		
	C50/60 [-]																1.55		
ψ_c																			
Concrete cone and splitting failure																			
HSL4, HSL4-G, HSL4-B, HSL4-SK																			
Installation safety factor	γ_{inst} [-]																1.0		
Factor	$k_1=k_{ucr,N}$ [-]																11.0		
	$k_1=k_{cr,N}$ [-]																7.7		
Spacing	$s_{cr,N}$ [mm]																$3 \cdot h_{ef}$		
Edge distance	$c_{cr,N}$ [mm]																$1.5 \cdot h_{ef}$		
HSL4, HSL4-G, HSL4-B, HSL4-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

(1) Pull-out failure is not decisive for design.

ANNEX C3

Performances

Characteristic resistance under shear load

This annex applies to the product described in the main body of the UK Technical Assessment.

Table C2: Characteristic values of resistance under shear load in case of static and quasi-static loading HSL4, HSL4-G, HSL4-B, HSL4-SK

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																			
HSL4, HSL4-G, HSL4-B, HSL4-SK																			
Partial safety factor	$\gamma_{Ms,V}$ [-]	1.25																	
Ductility factor	k_7 [-]	1.0																	
HSL4, HSL4-B																			
Characteristic resistance	$V_{Rk,s}$ [kN]	31.1			60.5			89.6			158.5			186.0			204.5		
HSL4-SK																			
Characteristic resistance	$t_{fix}^{(1)}$ [mm]	≥ 11			≥ 11			≥ 13			-								
	$V_{Rk,s}$ [kN]	31.1			60.5			89.6											
	$t_{fix}^{(1)}$ [mm]	< 11			< 11			< 13											
	$V_{Rk,s}$ [kN]	14.6			23.2			33.7											
HSL4-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		

⁽¹⁾ The influence of the thickness of fixture to the characteristic resistance for shear loads, steel failure without lever arm is considered.

ANNEX C4
Performances
Characteristic resistance under shear load

This annex applies to the product described in the main body of the UK Technical Assessment.

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																		
HSL4, HSL4-G, HSL4-B, HSL4-SK																		
Partial safety factor $\gamma_{Ms,V}$ [-]	1.25																	
Ductility factor k_7 [-]	1.0																	
Characteristic resistance $M^0_{Rk,s}$ [Nm]	30			60			105			266			519			898		
Concrete pry-out failure																		
HSL4, HSL4-G, HSL4-B, HSL4-SK																		
Pry-out factor k_8 [-]	2.4			2.6			2.7			2.8			3.8			3.2		
Installation safety factor γ_{inst} [-]	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_{inst} [-]	1.0																	

ANNEX C5
Performances
Displacements

This annex applies to the product described in the main body of the UK Technical Assessment.

Table C3: Displacements under tension load in case of static and quasi-static loading - HSL4, HSL4-G, HSL4-B, HSL4-SK

Size			M8	M10	M12	M16	M20	M24
HSL4, HSL4-G, HSL4-B, HSL4-SK								
Tension load in uncracked 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

Table C4: Displacements under shear load in case of static and quasi-static loading - HSL4, HSL4-G, HSL4-B, HSL4-SK

Size			M8	M10	M12	M16	M20	M24
HSL4, HSL4-B, HSL4-SK								
Shear load in cracked and uncracked 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
HSL4-G								
Shear load in cracked and uncracked 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

ANNEX C6

Performances

Characteristic resistance under seismic actions, seismic category C1

This annex applies to the product described in the main body of the UK Technical Assessment.

Table C5: Characteristic values of resistance under tension load in case of seismic category C1 - HSL4, HSL4-G, HSL4-B, HSL4-SK

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																		
HSL4, HSL4-G, HSL4-B, HSL4-SK																		
Partial safety factor $\gamma_{Ms,seis}^{(1)}$ [-]	1.5																	
HSL4, HSL4-G, HSL4-B, HSL4-SK																		
Characteristic resistance $N_{Rk,s,seis}$ [kN]	29.3			46.4			67.4			125.6			196.0			282.4		
Pull-out failure																		
HSL4, HSL4-G, HSL4-B, HSL4-SK																		
Installation safety factor γ_{inst} [-]	1.0																	
HSL4, HSL4-G, HSL4-B, HSL4-SK																		
Characteristic resistance $N_{Rk,p,seis}$ [kN]	12	12	12	16	16	16	- ⁽²⁾	24	24	- ⁽²⁾	36	36	- ⁽²⁾	50	50	- ⁽²⁾	65	65
Concrete cone failure																		
HSL4, HSL4-G, HSL4-B, HSL4-SK																		
Installation safety factor γ_{inst} [-]	1.0																	

⁽¹⁾ In absence of other national regulations

⁽²⁾ Pull-out failure is not decisive for design

ANNEX C7

Performances

Characteristic resistance under seismic actions, seismic category C1

This annex applies to the product described in the main body of the UK Technical Assessment.

Table C6: Characteristic values of resistance under shear load in case of seismic category C1 – HSL4, HSL4-G, HSL4-B, HSL4-SK

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																		
HSL4, HSL4-G, HSL4-B, HSL4-SK																		
Partial safety factor $\gamma_{Ms,seis}^{(1)}$ [-]	1.25																	
HSL4, HSL4-B																		
Characteristic resistance $V_{Rk,s,seis}$ [kN]	17.7			44.2			58.2			114.1			109.7			163.6		
HSL4-SK																		
Characteristic resistance $t_{fix}^{(2)}$ [mm]	≥11			≥11			≥13											
Characteristic resistance $V_{Rk,s,seis}$ [kN]	17.7			44.2			58.2			-								
HSL4-G																		
Characteristic resistance $V_{Rk,s,seis}$ [kN]	14.9			30.5			38.5			86.8			91.6			-		
Concrete pry-out failure																		
Installation safety factor γ_{inst} [-]	1.0																	
Concrete edge failure																		
Installation safety factor γ_{inst} [-]	1.0																	

⁽¹⁾ In absence of other national regulations

⁽²⁾ The influence of the thickness of fixture to the characteristic resistance for shear loads, steel failure without lever arm is considered.

ANNEX C8
Performances
Displacements seismic category C1

This annex applies to the product described in the main body of the UK Technical Assessment.

Table C7: Displacements under tension load in case of seismic category C1 - HSL4, HSL4-G, HSL4-B, HSL4-SK

Size	M8	M10	M12	M16	M20	M24
HSL4, HSL4-G, HSL4-B, HSL4-SK						
Displacement $\delta_{N,seis}$ [mm]	2.17	1.93	2.12	1.95	3.80	2.69

Table C8: Displacements under shear load in case of seismic category C1 - HSL4, HSL4-G, HSL4-B, HSL4-SK

Size	M8	M10	M12	M16	M20	M24
HSL4, HSL4-B, HSL4-SK						
Displacement $\delta_{V,seis}$ [mm]	4.61	4.47	5.18	5.70	4.23	5.95
HSL4-G						
Displacement $\delta_{V,seis}$ [mm]	4.61	4.47	5.18	5.70	4.23	-

ANNEX C9

Performances

Characteristic resistance under seismic actions, seismic category C2

This annex applies to the product described in the main body of the UK Technical Assessment.

Table C9: Characteristic values of resistance under tension load in case of seismic category C2 - HSL4, HSL4-G, HSL4-B, HSL4-SK

Size		M10			M12			M16			M20			M24		
Setting position		①	②	③	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	150	180	210
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			282.4		
Pull-out failure																
Installation safety factor	γ_{inst} [-]	1.0														
Characteristic resistance	$N_{Rk,p,seis}$ [kN]	12.2	12.2	12.2	- ⁽²⁾	25.8	25.8	34.2	34.2	34.2	40.1	40.1	40.1	45.9	45.9	45.9
Concrete cone failure																
Installation safety factor	γ_{inst} [-]	1.0														

⁽¹⁾ In absence of other national regulations

⁽²⁾ Pull-out failure is not decisive for design

ANNEX C10

Performances

Characteristic resistance under seismic actions, seismic category C2

This annex applies to the product described in the main body of the UK Technical Assessment.

Table C10: Characteristic values of resistance under shear load in case of seismic category C2 - HSL4, HSL4-G, HSL4-B, HSL4-SK

Size	M10			M12			M16			M20			M24			
Setting position	①	②	③	①	①	②	③	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	150	180	210	
Steel failure without lever arm																
Partial safety factor $\gamma_{Ms,seis}^{(1)}$ [-]	1.25															
HSL4, HSL4-B																
Characteristic resistance $V_{Rk,s,seis}$ [kN]	25.4			30.5			61.8			78.1			87.9			
HSL4-SK																
Characteristic resistance	$t_{fix}^{(2)}$ [mm]	≥11			≥13			-								
	$V_{Rk,s,seis}$ [kN]	25.4			30.5											
HSL4-G																
Characteristic resistance $V_{Rk,s,seis}$ [kN]	22.5			22.5			44.6			50.2			77.7			
Concrete pry-out failure																
Installation safety factor γ_{inst} [-]	1.0															
Concrete edge failure																
Installation safety factor γ_{inst} [-]	1.0															

⁽¹⁾ In absence of other national regulations

⁽²⁾ The influence of the thickness of fixture to the characteristic resistance for shear loads, steel failure without lever arm is considered.

ANNEX C11
Performances
Displacements seismic category C2

This annex applies to the product described in the main body of the UK Technical Assessment.

Table C11: Displacements under tension load in case of seismic category C2 - HSL4, HSL4-G, HSL4-B, HSL4-SK

Size		M10	M12	M16	M20	M24
Displacement DLS	$\delta_{N,seis(DLS)}$ [mm]	3.63	5.27	5.42	3.95	3.73
Displacement ULS	$\delta_{N,seis(ULS)}$ [mm]	13.09	14.68	16.02	12.25	24.26

Table C12: Displacements under shear load in case of seismic category C2 - HSL4, HSL4-B, HSL4-SK

Size		M10	M12	M16	M20	M24
Displacement DLS	$\delta_{V,seis(DLS)}$ [mm]	3.17	4.15	4.55	6.29	4.37
Displacement ULS	$\delta_{V,seis(ULS)}$ [mm]	7.12	7.31	18.31	14.16	19.51

Table C13: Displacements under shear load in case of seismic category C2 - HSL4-G

Size		M10	M12	M16	M20	M24
Displacement DLS	$\delta_{V,seis(DLS)}$ [mm]	3.13	5.68	5.58	5.88	4.48
Displacement ULS	$\delta_{V,seis(ULS)}$ [mm]	7.46	10.17	9.08	9.70	10.81

ANNEX C12

Performances

Characteristic resistance of tension load resistance under fire resistance

This annex applies to the product described in the main body of the UK Technical Assessment.

Table C14: Characteristic tension resistance under fire exposure for Hilti metal expansion anchor HSL4, HSL4-G, HSL4-B, HSL4-SK in cracked and uncracked 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																															
HSL4, HSL4-G, HSL4-B, HSL4-SK																															
Characteristic resistance	R30 $N_{Rk,s,fi}$ [kN]	2.7			4.2			6.0			11.1			17.4			25.0														
	R60 $N_{Rk,s,fi}$ [kN]	2.1			3.5			5.3			9.9			15.4			22.2														
	R90 $N_{Rk,s,fi}$ [kN]	1.5			2.8			4.6			8.6			13.4			19.3														
	R120 $N_{Rk,s,fi}$ [kN]	1.2			2.4			4.3			8.0			12.4			17.9														
Pull-out failure																															
HSL4, HSL4-G, HSL4-B, HSL4-SK																															
Characteristic resistance $\geq C20/25$	R30 $N_{Rk,p,fi}$ [kN]																														
	R60 $N_{Rk,p,fi}$ [kN]	3.0			4.0			- ⁽¹⁾			6.0			- ⁽¹⁾			9.0			- ⁽¹⁾			12.5			- ⁽¹⁾			16.3		
	R90 $N_{Rk,p,fi}$ [kN]																														
	R120 $N_{Rk,p,fi}$ [kN]	2.4			3.2			- ⁽¹⁾			4.8			- ⁽¹⁾			7.2			- ⁽¹⁾			10.0			- ⁽¹⁾			13.0		

⁽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.

ANNEX C13

Performances

Characteristic resistance of tension load resistance under fire resistance

This annex applies to the product described in the main body of the UK Technical Assessment.

Table C14: 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										
HSL4, HSL4-G, HSL4-B, HSL4-SK										
Characteristic resistance $\geq C20/25$	R30 $N_{Rk,c,fi}$ [kN]									
	R60 $N_{Rk,c,fi}$ [kN]									
	R90 $N_{Rk,c,fi}$ [kN]	5.0	10.3	18.0	7.4	13.8	22.8	10.3	20.3	34.7
	R120 $N_{Rk,c,fi}$ [kN]	4.0	8.2	14.4	5.9	11.1	18.3	8.2	16.3	27.7
Spacing $s_{cr,N}$ [mm]	240	320	400	280	360	440	320	420	520	
Edge distance $c_{cr,N}$ [mm]	120	160	200	140	180	220	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										
HSL4, HSL4-G, HSL4-B, HSL4-SK										
Characteristic resistance $\geq C20/25$	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	115.0
	R120 $N_{Rk,c,fi}$ [kN]	14.4	25.2	39.7	25.2	43.1	67.0	39.7	62.6	92.0
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.

ANNEX C14

Performances

Characteristic resistance of shear load resistance under fire resistance

This annex applies to the product described in the main body of the UK Technical Assessment.

Table C15: Characteristic shear resistance under fire exposure for Hilti metal expansion anchor HSL4, HSL4-G, HSL4-B, HSL4-SK in cracked and uncracked 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																			
HSL4, HSL4-G, HSL4-B, HSL4-SK																			
Characteristic resistance	R30 $V_{RK,s,fi}$ [kN]	2.7			4.2			6.0			11.1			17.4			25.0		
	R60 $V_{RK,s,fi}$ [kN]	2.1			3.5			5.3			9.9			15.4			22.2		
	R90 $V_{RK,s,fi}$ [kN]	1.5			2.8			4.6			8.6			13.4			19.3		
	R120V $V_{RK,s,fi}$ [kN]	1.2			2.4			4.3			8.0			12.4			17.9		
Steel failure with lever arm																			
HSL4, HSL4-G, HSL4-B, HSL4-SK																			
Characteristic resistance	R30 $M^0_{RK,s,fi}$ [Nm]	2.8			5.5			9.3			23.6			45.9			79.5		
	R60 $M^0_{RK,s,fi}$ [Nm]	2.2			4.5			8.2			20.9			40.8			70.5		
	R90 $M^0_{RK,s,fi}$ [Nm]	1.6			3.6			7.2			18.2			35.6			61.5		
	R120M $M^0_{RK,s,fi}$ [Nm]	1.3			3.1			6.7			16.9			33.0			57.0		

In absence of other national regulations the partial safety factor for resistance under fire exposure, $\gamma_{M,fi} = 1.0$ is recommended.

ANNEX C15

Performances

Characteristic resistance of shear load resistance under fire resistance

This annex applies to the product described in the main body of the UK Technical Assessment.

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 pry-out failure										
Pry-out factor k_8 [-]		2.4			2.6			2.7		
HSL4, HSL4-G, HSL4-B, HSL4-SK										
Characteristic resistance $\geq C20/25$	R30 $V_{Rk,cp,fi}$ [kN]	12.0	24.7	43.2	19.2	36.0	59.4	27.8	54.9	93.6
	R60 $V_{Rk,cp,fi}$ [kN]									
	R90 $V_{Rk,cp,fi}$ [kN]									
	R120 $V_{Rk,cp,fi}$ [kN]									
		9.6	19.8	34.6	15.3	28.8	47.5	22.3	43.9	74.9

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 pry-out failure										
Pry-out factor k_8 [-]		2.8			3.8			3.2		
HSL4, HSL4-G, HSL4-B, HSL4-SK										
Characteristic resistance $\geq C20/25$	R30 $V_{Rk,cp,fi}$ [kN]	50.4	88.0	138.9	119.5	204.6	318.4	158.7	250.4	368.1
	R60 $V_{Rk,cp,fi}$ [kN]									
	R90 $V_{Rk,cp,fi}$ [kN]									
	R120 $V_{Rk,cp,fi}$ [kN]									
		40.3	70.4	111.1	95.6	163.7	254.7	127.0	200.3	294.5
Concrete edge failure										
The initial value $V_{Rk,c,fi}^0$ of the characteristic resistance in concrete C20/25 to C50/60 under fire exposure may be determined by:										
$V_{Rk,c,fi}^0 = 0.25 \times V_{Rk,c}^0 (\leq R90) \quad V_{Rk,c,fi}^0 = 0.20 \times V_{Rk,c}^0 (R120)$										
with $V_{Rk,c,fi}^0$ 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.



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