The following excerpt are pages from the North American Product Technical Guide, Volume 2: Anchor Fastening, Edition 19.

Please refer to the publication in its entirety for complete details on this product including data development, product specifications, general suitability, installation, corrosion and spacing and edge distance guidelines.
US&CA: https://submittals.us.hilti.com/PTGVol2/

To consult directly with a team member regarding our anchor fastening products, contact Hilti's team of technical support specialists between the hours of 7:00am – 6:00pm CST.
US: 877-749-6337 or HNATechnicalServices@hilti.com
CA: 1-800-363-4458, ext. 6 or CATechnicalServices@hilti.com

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3.3.2 HSL-3 HEAVY-DUTY EXPANSION ANCHORS

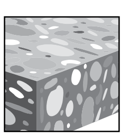
PRODUCT DESCRIPTION

HSL-3 heavy-duty expansion anchors

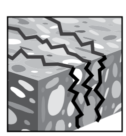
Anchor System			
HSL-3 Heavy-duty Expansion Anchor	HSL-3-B Heavy-duty Expansion Anchor with Torque Cap	HSL-3-G Heavy-duty Expansion Anchor with Threaded Rod	HSL-3-SK Countersunk version available as special

Features and Benefits

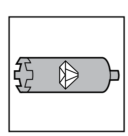
- Approved for use in the concrete tension zone (cracked concrete)
- Approved for use with cored drilled holes using the Hilti diamond coring tool, DD 120 with the DD-BI core bit or with the Hilti Diamond Coring Tool DD EC-1 with the DD-C T2 core bit.
- Data for use with the Strength Design provisions of ACI 318-14 Chapter 17 and ACI 349 Appendix B
- High load capacity
- Force-controlled expansion which allows for follow-up expansion
- Reliable clamping of part fastened to help overcome gaps
- Suitable for dynamic loading, including seismic, fatigue and shock
- No spinning of the anchor in hole when tightening bolt or nut
- Seismic qualification per ICC-ES AC193 and the requirements of ACI 318-14 Chapter 17
- ACI 349-01 Nuclear Design Guide is available. Call Hilti Technical Support



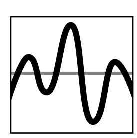
Uncracked concrete



Cracked concrete



Diamond cored holes for Cracked and Uncracked Concrete



Seismic Design Categories A-F

Profis Anchor design software

Approvals/Listings	
ICC-ES (International Code Council)	ESR-1545 in concrete per ACI 318-14 Ch. 17 / ACI 355.2/ ICC-ES AC193
European Technical Approval	ETA-02/0042
City of Los Angeles	Research Report No. 25903
Nuclear Quality Assurance	Qualified under NQA-1 Nuclear Quality Program

MATERIAL SPECIFICATIONS

Carbon steel bolt or threaded rod for HSL-3, HSL-3-G and HSL-3-B conform to the steel strength requirements of ISO 898-1, grade 8.8, f_{ya} > 93 ksi, f_{uta} > 116 ksi.
Carbon steel nut conforms to DIN 934, Grade 8, f_{uta} > 116 ksi.
Carbon steel washer conforms to DIN 1544, Grade ST37, f_{uta} > 100 ksi.
Carbon steel expansion cone conforms to DIN 1654-4, f_{uta} > 80 ksi.
Carbon steel expansion sleeve M8-M16 conforms to DIN 10139 and M20-M24 conforms to DIN 2392-2.
Carbon steel spacing sleeve conforms to DIN 2393 T1, f_{uta} > 100ksi.
Collapsible sleeve is made from acetal polyoxymethylene (POM) resin.

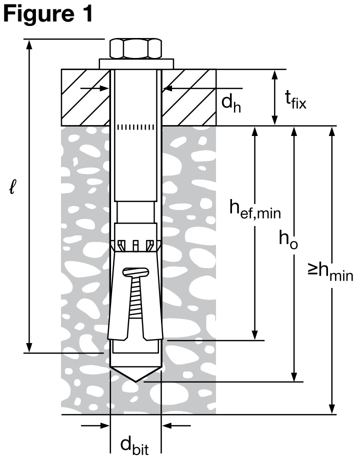
INSTALLATION PARAMETERS

Table 1 — Hilti HSL-3 specifications

Details			HSL-3 anchor thread diameter											
			M8		M10		M12		M16		M20		M24	
Nominal drill bit diameter[1]	d_{bit}	mm	12		15		18		24		28		32	
Minimum concrete thickness	h_{min}	mm (in.)	See table 5											
Minimum hole depth	h_o	mm	80		90		105		125		155		180	
		(in.)	(3-1/8)		(3-1/2)		(4-1/8)		(4-7/8)		(6-1/8)		(7-1/8)	
Effective minimum embedment	$h_{ef,min}$	mm	60		70		80		100		125		150	
		(in.)	(2-3/8)		(2-3/4)		(3-1/8)		(3-7/8)		(4-7/8)		(5-7/8)	
Fixture hole diameter	d_h	mm	14		17		20		26		31		35	
		(in.)	(9/16)		(11/16)		(13/16)		(1)		(1-1/4)		(1-3/8)	
Max. cumulative gap between part(s) being fastened and concrete surface	–	mm	4		5		8		9		12		16	
		(in.)	(1/8)		(3/16)		(5/16)		(3/8)		(1/2)		(5/8)	
Maximum thickness of part fastened HSL-3, HSL-3-B	t_{fix}	mm	20	40	20	40	25	50	25	50	30	60	30	60
		(in.)	(3/4)	(1-1/2)	(3/4)	(1-1/2)	(1)	(2)	(1)	(2)	(1-1/8)	(2-1/4)	(1-1/8)	(2-1/4)
Overall length of anchor HSL-3, HSL-3-B	ℓ	mm	98	118	110	130	131	156	153	178	183	213	205	235
		(in.)	(3-7/8)	(4-5/8)	(4-3/8)	(5 1/8)	(5-1/8)	(6 1/8)	(6)	(7)	(7-1/4)	(8-3/8)	(8)	(9-1/4)
Maximum thickness of part fastened HSL-3-G	t_{fix}	mm	20		20		25	50	25	50	30	60	30	60
		(in.)	(3/4)		(3/4)		(1)	(2)	(1)	(2)	(1-1/8)	(2-1/4)	(1-1/8)	(2-1/4)
Overall length of anchor HSL-3-G	ℓ	mm	102		115		139	164	163	188	190	220	–	–
		(in.)	(4)		(4-1/2)		(5-1/2)	(6-3/8)	(6-3/8)	(7-3/8)	(7-1/2)	(8-3/4)	–	–
Washer diameter	d_w	mm	20		25		30		40		45		50	
		(in.)	(3/4)		(1)		(1-1/8)		(1-9/16)		(1-3/4)		(2)	
Installation torque HSL-3	T_{inst}	Nm	25		50		80		120		200		250	
		(ft-lb)	(18)		(37)		(59)		(89)		(148)		(185)	
Installation torque HSL-3-G	T_{inst}	Nm	20		35		60		80		160		180	
		(ft-lb)	(15)		(26)		(44)		(59)		(118)		(132)	
Wrench size HSL-3, HSL-3-G	–	mm	13		17		19		24		30		36	
Wrench size HSL-3-B	–	mm					24		30		36		41	

1 Use metric bits only.

Figure 1



DESIGN DATA IN CONCRETE PER ACI 318

ACI 318-14 Chapter 17 design

The load values contained in this section are Hilti Simplified Design Tables. The load tables in this section were developed using the Strength Design parameters and variables of ESR-1545 and the equations within ACI 318-14 Chapter 17. For a detailed explanation of the Hilti Simplified Design Tables, refer to section 3.1.8. Data tables from ESR 1545 are not contained in this section, but can be found at www.icc-es.org or at www.hilti.com.

Table 2 - Hilti HSL-3 design strength with concrete / pullout failure in uncracked concrete[1,2,3,4,5]

Nominal anchor diameter	Effective embed. mm (in.)	Tension - ϕN_n				Shear - ϕV_n			
		f'_c = 2,500 psi lb (kN)	f'_c = 3,000 psi lb (kN)	f'_c = 4,000 psi lb (kN)"	f'_c = 6,000 psi lb (kN)	f'_c = 2,500 psi lb (kN)	f'_c = 3,000 psi lb (kN)	f'_c = 4,000 psi lb (kN)	f'_c = 6,000 psi lb (kN)
M8	60	2,735	2,995	3,455	4,235	3,050	3,340	3,860	4,725
	(2.4)	(12.2)	(13.3)	(15.4)	(18.8)	(13.6)	(14.9)	(17.2)	(21.0)
M10	70	3,570	3,910	4,515	5,530	7,685	8,420	9,720	11,905
	(2.8)	(15.9)	(17.4)	(20.1)	(24.6)	(34.2)	(37.5)	(43.2)	(53.0)
M12	80	4,360	4,775	5,515	6,755	9,390	10,285	11,880	14,550
	(3.2)	(19.4)	(21.2)	(24.5)	(30.0)	(41.8)	(45.7)	(52.8)	(64.7)
M16	100	6,095	6,675	7,705	9,440	13,125	14,375	16,600	20,330
	(3.9)	(27.1)	(29.7)	(34.3)	(42.0)	(58.4)	(63.9)	(73.8)	(90.4)
M20	125	8,515	9,330	10,770	13,190	18,340	20,090	23,200	28,415
	(4.9)	(37.9)	(41.5)	(47.9)	(58.7)	(81.6)	(89.4)	(103.2)	(126.4)
M24	150	11,195	12,260	14,160	17,340	24,110	26,410	30,495	37,350
	(5.9)	(49.8)	(54.5)	(63.0)	(77.1)	(107.2)	(117.5)	(135.6)	(166.1)

Table 3 - Hilti HSL-3 design strength with concrete / pullout failure in cracked concrete[1,2,3,4,5]

Nominal anchor diameter	Effective embed. mm (in.)	Tension - ϕN_n				Shear - ϕV_n			
		f'_c = 2,500 psi lb (kN)	f'_c = 3,000 psi lb (kN)	f'_c = 4,000 psi lb (kN)"	f'_c = 6,000 psi lb (kN)	f'_c = 2,500 psi lb (kN)	f'_c = 3,000 psi lb (kN)	f'_c = 4,000 psi lb (kN)	f'_c = 6,000 psi lb (kN)
M8	60	1,825	2,000	2,310	2,830	2,160	2,365	2,730	3,345
	(2.4)	(8.1)	(8.9)	(10.3)	(12.6)	(9.6)	(10.5)	(12.1)	(14.9)
M10	70	2,920	3,200	3,695	4,525	7,685	8,420	9,720	11,905
	(2.8)	(13.0)	(14.2)	(16.4)	(20.1)	(34.2)	(37.5)	(43.2)	(53.0)
M12	80	4,360	4,775	5,515	6,755	9,390	10,285	11,880	14,550
	(3.2)	(19.4)	(21.2)	(24.5)	(30.0)	(41.8)	(45.7)	(52.8)	(64.7)
M16	100	6,095	6,675	7,705	9,440	13,125	14,375	16,600	20,330
	(3.9)	(27.1)	(29.7)	(34.3)	(42.0)	(58.4)	(63.9)	(73.8)	(90.4)
M20	125	8,515	9,330	10,770	13,190	18,340	20,090	23,200	28,415
	(4.9)	(37.9)	(41.5)	(47.9)	(58.7)	(81.6)	(89.4)	(103.2)	(126.4)
M24	150	11,195	12,260	14,160	17,340	24,110	26,410	30,495	37,350
	(5.9)	(49.8)	(54.5)	(63.0)	(77.1)	(107.2)	(117.5)	(135.6)	(166.1)

1 See section 3.1.8 to convert design strength value to ASD value.
2 Linear interpolation between embedment depths and concrete compressive strengths is not permitted.
3 Apply spacing, edge distance, and concrete thickness factors in tables 5 to 8 as necessary. Compare to the steel values in table 4. The lesser of the values is to be used for the design.
4 Tabular values are for normal-weight concrete only. For lightweight concrete multiply design strength by λ_a as follows: for sand-lightweight, λ_a = 0.68; for all-lightweight, λ_a = 0.60.
5 Tabular values are for static loads only. Seismic design is not permitted for uncracked concrete. HSL-3-G is not approved for seismic design. For all seismic tension loads for all other anchors, multiply cracked concrete tabular values in tension only by the following reduction factors:
M24 - $\alpha_{N,seis}$ = 0.62
All other sizes - $\alpha_{N,seis}$ = 0.75
No reduction needed for seismic shear. See section 3.1.8 for additional information on seismic applications.

Table 4 - Steel strength for Hilti HSL-3 anchors[1,2]

Nominal anchor diameter	HSL-3, HSL-3-B, HSL-3-SK, HSL-3-SH			HSL-3-G		
	Tensile[3] ϕN_{sa} lb (kN)	Shear[4] ϕV_{sa} lb (kN)	Seismic shear[5] $\phi V_{sa,eq}$ lb (kN)	Tensile[3] ϕN_{sa} lb (kN)	Shear[4] ϕV_{sa} lb (kN)	Seismic shear[5] $\phi V_{sa,eq}$ lb (kN)
M8	4,960 (22.1)	4,705 (20.9)	2,995 (13.3)	4,960 (22.1)	3,945 (17.5)	2,455 (10.9)
M10	7,830 (34.8)	6,650 (29.6)	5,495 (24.4)	7,830 (34.8)	5,450 (24.2)	4,500 (20.0)
M12	11,395 (50.7)	9,570 (42.6)	7,730 (34.4)	11,395 (50.7)	7,905 (35.2)	6,385 (28.4)
M16	21,140 (94.0)	17,360 (77.2)	16,115 (71.7)	21,140 (94.0)	14,745 (65.6)	13,690 (60.9)
M20	33,060 (147.1)	25,690 (114.3)	18,940 (84.2)	33,060 (147.1)	21,555 (95.9)	15,900 (70.7)
M24	47,590 (211.7)	29,870 (132.9)	24,810 (110.4)	47,590 (211.7)	28,060 (124.8)	n/a

1 See section 3.1.8 to convert design strength value to ASD value.
2 Hilti HSL-3 Carbon Steel anchors are to be considered ductile steel elements.
3 Tensile $\phi N_{sa} = \phi_{Ase,N} f_{uta}$ as noted in ACI 318-14 Chapter 17
4 Shear values determined by static shear tests with $\phi V_{sa} \leq \phi\ 0.60\ A_{se,V}\ f_{uta}$ as noted in ACI 318-14 Chapter 17
5 Seismic shear values determined by seismic shear tests with $\phi V_{sa,\ eq} \leq \phi\ 0.60\ A_{se,V}\ f_{uta}$ as noted in ACI 318-14 Chapter 17
See section 3.1.8 for additional information on seismic applications.

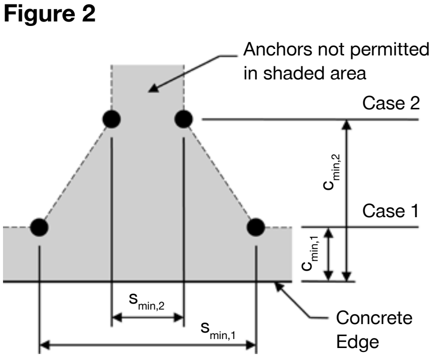
Table 5 — Edge distance, spacing and member thickness requirements[1]

Condition	Dimensional parameter		Symbol	Units	Nominal anchor diameter M8	M10	M12	M16	M20	M24
A	Minimum concrete thickness		h_{min}	in. (mm)	4-3/4 (120)	5-1/2 (140)	6-1/4 (160)	7-7/8 (200)	9-7/8 (250)	11-7/8 (300)
	Critical edge distance		c_{ac}	in. (mm)	4-3/8 (110)	4-3/8 (110)	4-3/4 (120)	5-7/8 (150)	8-7/8 (225)	8-7/8 (225)
	Case 1	Minimum edge distance	$c_{min,1}$	in. (mm)	2-3/8 (60)	2-3/4 (70)	3-1/2 (90)	4-3/4 (120)	5 (125)	5-7/8 (150)
		Minimum anchor spacing	$s_{min,1}$	in. (mm)	5-1/2 (140)	9-1/2 (240)	11 (280)	12-5/8 (320)	13-3/4 (350)	11-7/8 (300)
	Case 2	Minimum edge distance	$c_{min,2}$	in. (mm)	3-3/8 (85)	5 (125)	6-1/8 (155)	7-7/8 (200)	8-1/4 (210)	8-1/4 (210)
		Minimum anchor spacing	$s_{min,2}$	in. (mm)	2-3/8 (60)	2-3/4 (70)	3-1/8 (80)	4 (100)	5 (125)	5-7/8 (150)
B	Minimum concrete thickness		h_{min}	in. (mm)	4-3/8 (110)	4-3/4 (120)	5-3/8 (135)	6-1/4 (160)	7-1/2 (190)	8-7/8 (225)
	Critical edge distance		c_{ac}	in. (mm)	5-7/8 (150)	6-7/8 (175)	7-7/8 (200)	9-7/8 (250)	12-3/8 (312.5)	14-3/4 (375)
	Case 1	Minimum edge distance	$c_{min,1}$	in. (mm)	2-3/8 (60)	3-1/2 (90)	4-3/8 (110)	6-1/4 (160)	7-7/8 (200)	8-7/8 (225)
		Minimum anchor spacing	$s_{min,1}$	in. (mm)	7 (180)	10-1/4 (260)	12-5/8 (320)	15 (380)	15-3/4 (400)	15 (380)
	Case 2	Minimum edge distance	$c_{min,2}$	in. (mm)	4 (100)	6-1/4 (160)	7-7/8 (200)	10-5/8 (270)	11-7/8 (300)	12-5/8 (320)
		Minimum anchor spacing	$s_{min,2}$	in. (mm)	2-3/8 (60)	2-3/4 (70)	3-1/8 (80)	4 (100)	5 (125)	5-7/8 (150)

1 Linear interpolation is permitted to establish an edge distance and spacing combination between Case 1 and Case 2. Linear interpolation for a specific edge distance c, where $c_{min,1} < c < c_{min,2}$ will determine the permissible spacing s as follows:

$$s \geq s_{min,2} + \frac{(s_{min,1} - s_{min,2})}{(c_{min,1} - c_{min,2})}(c - c_{min,2})$$

Figure 2



For a specific edge distance, the permitted spacing is calculated as follows:

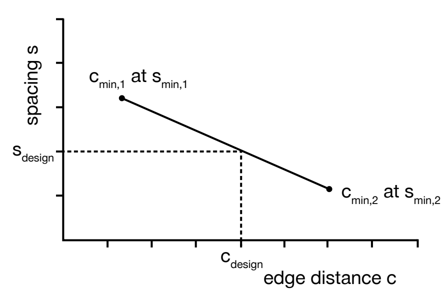


Table 6 - Load adjustment factors for M8, M10, and M12 Hilti HSL-3 anchors in uncracked concrete[1,2]

M8, M10 and M12 HSL-3 uncracked concrete		Spacing factor in tension f_{AN}			Edge distance factor in tension f_{RN}			Spacing factor in shear[3] f_{AV}			Edge distance in shear ⊥ toward edge f_{RV}			Edge distance in shear II to and away from edge f_{RV}			Conc. thickness factor in shear[4] f_{HV}		
Nominal dia.		M8	M10	M12	M8	M10	M12	M8	M10	M12	M8	M10	M12	M8	M10	M12	M8	M10	M12
Effective embedment h_{ef}	mm	60	70	80	60	70	80	60	70	80	60	70	80	60	70	80	60	70	80
	(in.)	(2.36)	(2.76)	(3.15)	(2.36)	(2.76)	(3.15)	(2.36)	(2.76)	(3.15)	(2.36)	(2.76)	(3.15)	(2.36)	(2.76)	(3.15)	(2.36)	(2.76)	(3.15)
Spacing (s) / edge distance (c_a) / concrete thickness (h) - in. (mm) 2-3/8	(60)	0.67	n/a	n/a	0.45	n/a	n/a	0.58	n/a	n/a	0.32	n/a	n/a	0.45	n/a	n/a	n/a	n/a	n/a
2-1/2	(64)	0.68	n/a	n/a	0.47	n/a	n/a	0.58	n/a	n/a	0.35	n/a	n/a	0.47	n/a	n/a	n/a	n/a	n/a
2-3/4	(70)	0.69	0.67	n/a	0.50	0.45	n/a	0.59	0.55	n/a	0.40	0.18	n/a	0.50	0.36	n/a	n/a	n/a	n/a
3	(76)	0.71	0.68	n/a	0.53	0.48	n/a	0.60	0.56	n/a	0.46	0.20	n/a	0.53	0.41	n/a	n/a	n/a	n/a
3-1/8	(79)	0.72	0.69	0.67	0.55	0.49	n/a	0.60	0.56	0.56	0.49	0.22	n/a	0.55	0.44	n/a	n/a	n/a	n/a
3-1/2	(89)	0.75	0.71	0.69	0.60	0.53	0.48	0.62	0.57	0.56	0.58	0.26	0.23	0.60	0.52	0.46	n/a	n/a	n/a
4	(102)	0.78	0.74	0.71	0.68	0.59	0.53	0.63	0.58	0.57	0.71	0.32	0.28	0.71	0.59	0.53	n/a	n/a	n/a
4-3/8	(111)	0.81	0.76	0.73	0.74	0.64	0.56	0.65	0.58	0.58	0.81	0.36	0.32	0.81	0.64	0.56	0.76	n/a	n/a
4-1/2	(114)	0.82	0.77	0.74	0.77	0.65	0.58	0.65	0.59	0.58	0.85	0.38	0.34	0.85	0.65	0.58	0.77	n/a	n/a
4-3/4	(121)	0.84	0.79	0.75	0.81	0.69	0.60	0.66	0.59	0.59	0.92	0.41	0.37	0.92	0.69	0.60	0.79	0.61	n/a
5	(127)	0.85	0.80	0.76	0.85	0.73	0.63	0.67	0.60	0.59	0.99	0.44	0.40	0.99	0.73	0.63	0.81	0.62	n/a
5-3/8	(137)	0.88	0.83	0.78	0.91	0.78	0.68	0.68	0.60	0.60	1.00	0.49	0.44	1.00	0.78	0.68	0.84	0.64	0.62
6	(152)	0.92	0.86	0.82	1.00	0.87	0.76	0.70	0.62	0.61		0.58	0.52		0.87	0.76	0.89	0.68	0.66
7	(178)	0.99	0.92	0.87		1.00	0.89	0.73	0.64	0.63		0.73	0.65		1.00	0.89	0.96	0.73	0.71
8	(203)	1.00	0.98	0.92			1.00	0.77	0.65	0.64		0.89	0.80			1.00	1.00	0.79	0.76
9	(229)		1.00	0.98				0.80	0.67	0.66		1.00	0.95					0.83	0.80
10	(254)		1.00	1.00				0.83	0.69	0.68			1.00					0.88	0.85
12	(305)		1.00	1.00				0.90	0.73	0.72								0.96	0.93
14	(356)			1.00				0.96	0.77	0.75								1.00	1.00
16	(406)							1.00	0.81	0.79									
18	(457)								0.85	0.82									
20	(508)								0.89	0.86									
24	(610)								0.96	0.93									
> 30	(762)								1.00	1.00									

Table 7 - Load adjustment factors for M8, M10, and M12 Hilti HSL-3 anchors in cracked concrete[1,2]

M8, M10 and M12 HSL-3 cracked concrete		Spacing factor in tension f_{AN}			Edge distance factor in tension f_{RN}			Spacing factor in shear[3] f_{AV}			Edge distance in shear ⊥ toward edge f_{RV}			Edge distance in shear II to and away from edge f_{RV}			Conc. thickness factor in shear[4] f_{HV}		
Nominal dia.		M8	M10	M12	M8	M10	M12	M8	M10	M12	M8	M10	M12	M8	M10	M12	M8	M10	M12
Effective embedment h_{ef}	mm	60	70	80	60	70	80	60	70	80	60	70	80	60	70	80	60	70	80
	(in.)	(2.36)	(2.76)	(3.15)	(2.36)	(2.76)	(3.15)	(2.36)	(2.76)	(3.15)	(2.36)	(2.76)	(3.15)	(2.36)	(2.76)	(3.15)	(2.36)	(2.76)	(3.15)
Spacing (s) / edge distance (c_a) / concrete thickness (h) - in. (mm) 2-3/8	(60)	0.67	n/a	n/a	0.75	n/a	n/a	0.58	n/a	n/a	0.33	n/a	n/a	0.65	n/a	n/a	n/a	n/a	n/a
2-1/2	(64)	0.68	n/a	n/a	0.78	n/a	n/a	0.58	n/a	n/a	0.35	n/a	n/a	0.71	n/a	n/a	n/a	n/a	n/a
2-3/4	(70)	0.69	0.67	n/a	0.83	0.75	n/a	0.59	0.54	n/a	0.41	0.13	n/a	0.82	0.26	n/a	n/a	n/a	n/a
3	(76)	0.71	0.68	n/a	0.88	0.79	n/a	0.60	0.55	n/a	0.46	0.15	n/a	0.88	0.29	n/a	n/a	n/a	n/a
3-1/8	(79)	0.72	0.69	0.67	0.91	0.81	n/a	0.60	0.55	0.54	0.49	0.16	n/a	0.91	0.31	n/a	n/a	n/a	n/a
3-1/2	(89)	0.75	0.71	0.69	0.99	0.88	0.80	0.62	0.55	0.55	0.59	0.18	0.17	0.99	0.37	0.33	n/a	n/a	n/a
4	(102)	0.78	0.74	0.71	1.00	0.97	0.88	0.63	0.56	0.56	0.72	0.23	0.20	1.00	0.45	0.40	n/a	n/a	n/a
4-3/8	(111)	0.81	0.76	0.73		1.00	0.94	0.65	0.57	0.56	0.82	0.26	0.23		0.51	0.46	0.76	n/a	n/a
4-1/2	(114)	0.82	0.77	0.74		1.00	0.96	0.65	0.57	0.56	0.85	0.27	0.24		0.54	0.48	0.77	n/a	n/a
4-3/4	(121)	0.84	0.79	0.75		1.00	1.00	0.66	0.57	0.57	0.93	0.29	0.26		0.58	0.52	0.80	0.54	n/a
5	(127)	0.85	0.80	0.76		1.00	1.00	0.67	0.58	0.57	1.00	0.31	0.28		0.63	0.56	0.82	0.56	n/a
5-3/8	(137)	0.88	0.83	0.78		1.00	1.00	0.68	0.58	0.58		0.35	0.31		0.70	0.63	0.85	0.58	0.56
6	(152)	0.92	0.86	0.82		1.00	1.00	0.70	0.59	0.59		0.41	0.37		0.83	0.74	0.89	0.61	0.59
7	(178)	0.99	0.92	0.87		1.00	1.00	0.73	0.61	0.60		0.52	0.47		1.00	0.93	0.97	0.66	0.63
8	(203)	1.00	0.98	0.92			1.00	0.77	0.62	0.61		0.64	0.57			1.00	1.00	0.70	0.68
9	(229)		1.00	0.98				0.80	0.64	0.63		0.76	0.68					0.74	0.72
10	(254)		1.00	1.00				0.83	0.65	0.64		0.89	0.80					0.79	0.76
12	(305)		1.00	1.00				0.90	0.69	0.67		1.00	1.00					0.86	0.83
14	(356)			1.00				0.97	0.72	0.70								0.93	0.90
16	(406)							1.00	0.75	0.73								0.99	0.96
18	(457)								0.78	0.76								1.00	1.00
20	(508)								0.81	0.79									
24	(610)								0.87	0.84									
> 30	(762)								0.96	0.93									

1 Linear interpolation not permitted.

2 When combining multiple load adjustment factors (e.g. for a 4 anchor pattern in a corner with thin concrete member) the design can become very conservative. To optimize the design, use Hilti PROFIS Anchor Design software or perform anchor calculation using design equations from ACI 318-14 Chapter 17.

3 Spacing factor reduction in shear, f_{AV}, assumes an influence of a nearby edge. If no edge exists, then $f_{AV} = f_{AN}$.

4 Concrete thickness reduction factor in shear, f_{HV}, assumes an influence of a nearby edge. If no edge exists, then f_{HV} = 1.0.

If a reduction factor value is in a shaded cell, it may not be permitted if both edge and spacing are less than "critical" distances. Check table 5 and figure 2 of this section to calculate permissable edge distance, spacing and concrete thickness combinations. For the HSL-3-SH M8, M10 and M12 diameters, the minimum slab thickness must be increased by 5 mm (3/16-in.).

Table 8 - Load adjustment factors for M16, M20, and M24 Hilti HSL-3 anchors in uncracked concrete[1,2]

M16, M20 and M24 HSL-3 uncracked concrete		Spacing factor in tension f_{AN}			Edge distance factor in tension f_{RN}			Spacing factor in shear[3] f_{AV}			Edge distance in shear ⊥ toward edge f_{RV}			Edge distance in shear II to and away from edge f_{RV}			Conc. thickness factor in shear[4] f_{HV}		
Nominal dia.		M16	M20	M24	M16	M20	M24	M16	M20	M24	M16	M20	M24	M16	M20	M24	M16	M20	M24
Effective embedment h_{ef}	mm	100	125	150	100	125	150	100	125	150	100	125	150	100	125	150	100	125	150
	(in.)	(3.94)	(4.92)	(5.91)	(3.94)	(4.92)	(5.91)	(3.94)	(4.92)	(5.91)	(3.94)	(4.92)	(5.91)	(3.94)	(4.92)	(5.91)	(3.94)	(4.92)	(5.91)
Spacing (s) / edge distance (c_a) / concrete thickness (h) - in. (mm)																			
4	(102)	0.67	n/a	n/a	n/a	n/a	n/a	0.56	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
4-1/2	(114)	0.69	n/a	n/a	n/a	n/a	n/a	0.57	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
4-3/4	(121)	0.70	n/a	n/a	0.51	n/a	n/a	0.58	n/a	n/a	0.30	n/a	n/a	0.51	n/a	n/a	n/a	n/a	n/a
5	(127)	0.71	0.67	n/a	0.53	0.45	n/a	0.58	0.57	n/a	0.33	0.25	n/a	0.53	0.45	n/a	n/a	n/a	n/a
5-1/2	(140)	0.73	0.69	n/a	0.57	0.48	n/a	0.59	0.57	n/a	0.38	0.29	n/a	0.57	0.48	n/a	n/a	n/a	n/a
5-7/8	(149)	0.75	0.70	0.67	0.60	0.50	0.45	0.59	0.58	0.57	0.42	0.32	0.26	0.60	0.50	0.45	n/a	n/a	n/a
6	(152)	0.75	0.70	0.67	0.61	0.51	0.45	0.59	0.58	0.57	0.43	0.33	0.27	0.61	0.51	0.45	n/a	n/a	n/a
6-1/4	(159)	0.76	0.71	0.68	0.63	0.53	0.47	0.60	0.58	0.57	0.46	0.35	0.29	0.63	0.53	0.47	0.63	n/a	n/a
7	(178)	0.80	0.74	0.70	0.71	0.57	0.50	0.61	0.59	0.58	0.54	0.42	0.34	0.71	0.57	0.50	0.67	n/a	n/a
7-1/2	(191)	0.82	0.75	0.71	0.76	0.61	0.53	0.62	0.60	0.59	0.60	0.46	0.38	0.76	0.61	0.53	0.69	0.63	n/a
8	(203)	0.84	0.77	0.73	0.81	0.65	0.55	0.63	0.61	0.59	0.66	0.51	0.41	0.81	0.65	0.55	0.71	0.65	n/a
8-7/8	(225)	0.88	0.80	0.75	0.90	0.72	0.60	0.64	0.62	0.60	0.77	0.60	0.48	0.90	0.72	0.60	0.75	0.69	0.64
9	(229)	0.88	0.80	0.75	0.91	0.73	0.61	0.64	0.62	0.60	0.79	0.61	0.49	0.91	0.73	0.61	0.75	0.69	0.65
10	(254)	0.92	0.84	0.78	1.00	0.81	0.68	0.66	0.63	0.62	0.92	0.71	0.58	1.00	0.81	0.68	0.79	0.73	0.68
11	(279)	0.97	0.87	0.81	1.00	0.89	0.75	0.67	0.65	0.63	1.00	0.82	0.67	1.00	0.89	0.75	0.83	0.77	0.71
12	(305)	1.00	0.91	0.84		0.97	0.81	0.69	0.66	0.64		0.94	0.76		0.97	0.81	0.87	0.80	0.75
14	(356)	1.00	0.97	0.90		1.00	0.95	0.72	0.69	0.66		1.00	0.96		1.00	0.96	0.94	0.86	0.80
16	(406)	1.00	1.00	0.95			1.00	0.75	0.71	0.69			1.00			1.00	1.00	0.92	0.86
18	(457)			1.00				0.78	0.74	0.71								0.98	0.91
20	(508)							0.82	0.77	0.73								1.00	0.96
24	(610)							0.88	0.82	0.78									1.00
30	(762)							0.97	0.90	0.85									
36	(914)							1.00	0.98	0.92									
> 48	(1219)								1.00	1.00									

Table 9 - Load adjustment factors for M16, M20, and M24 Hilti HSL-3 anchors in cracked concrete[1,4]

M16, M20 and M24 HSL-3 cracked concrete		Spacing factor in tension f_{AN}			Edge distance factor in tension f_{RN}			Spacing factor in shear[3] f_{AV}			Edge distance in shear ⊥ toward edge f_{RV}			Edge distance in shear II to and away from edge f_{RV}			Conc. thickness factor in shear[4] f_{HV}		
Nominal dia.		M16	M20	M24	M16	M20	M24	M16	M20	M24	M16	M20	M24	M16	M20	M24	M16	M20	M24
Effective embedment h_{ef}	mm	100	125	150	100	125	150	100	125	150	100	125	150	100	125	150	100	125	150
	(in.)	(3.94)	(4.92)	(5.91)	(3.94)	(4.92)	(5.91)	(3.94)	(4.92)	(5.91)	(3.94)	(4.92)	(5.91)	(3.94)	(4.92)	(5.91)	(3.94)	(4.92)	(5.91)
Spacing (s) / edge distance (c_a) / concrete thickness (h) - in. (mm)																			
4	(102)	0.67	n/a	n/a	n/a	n/a	n/a	0.55	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
4-1/2	(114)	0.69	n/a	n/a	n/a	n/a	n/a	0.56	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
4-3/4	(121)	0.70	n/a	n/a	0.85	n/a	n/a	0.56	n/a	n/a	0.22	n/a	n/a	0.43	n/a	n/a	n/a	n/a	n/a
5	(127)	0.71	0.67	n/a	0.88	0.76	n/a	0.56	0.55	n/a	0.23	0.18	n/a	0.47	0.36	n/a	n/a	n/a	n/a
5-1/2	(140)	0.73	0.69	n/a	0.95	0.81	n/a	0.57	0.56	n/a	0.27	0.21	n/a	0.54	0.42	n/a	n/a	n/a	n/a
5-7/8	(149)	0.75	0.70	0.67	1.00	0.84	0.75	0.57	0.56	0.55	0.30	0.23	0.19	0.59	0.46	0.37	n/a	n/a	n/a
6	(152)	0.75	0.70	0.67	1.00	0.86	0.76	0.58	0.56	0.56	0.31	0.24	0.19	0.61	0.47	0.38	n/a	n/a	n/a
6-1/4	(159)	0.76	0.71	0.68	1.00	0.88	0.78	0.58	0.57	0.56	0.33	0.25	0.20	0.65	0.50	0.41	0.56	n/a	n/a
7	(178)	0.80	0.74	0.70	1.00	0.96	0.84	0.59	0.57	0.56	0.39	0.30	0.24	0.77	0.60	0.48	0.59	n/a	n/a
7-1/2	(191)	0.82	0.75	0.71	1.00	1.00	0.88	0.59	0.58	0.57	0.43	0.33	0.27	0.86	0.66	0.54	0.62	0.56	n/a
8	(203)	0.84	0.77	0.73	1.00	1.00	0.92	0.60	0.59	0.57	0.47	0.36	0.30	0.94	0.73	0.59	0.64	0.58	n/a
8-7/8	(225)	0.88	0.80	0.75	1.00	1.00	1.00	0.61	0.59	0.58	0.55	0.43	0.35	1.00	0.85	0.69	0.67	0.61	0.57
9	(229)	0.88	0.80	0.75	1.00	1.00	1.00	0.61	0.60	0.58	0.56	0.43	0.35	1.00	0.87	0.71	0.67	0.62	0.58
10	(254)	0.92	0.84	0.78	1.00	1.00	1.00	0.63	0.61	0.59	0.66	0.51	0.41	1.00	1.00	0.83	0.71	0.65	0.61
11	(279)	0.97	0.87	0.81	1.00	1.00	1.00	0.64	0.62	0.60	0.76	0.59	0.48	1.00	1.00	0.95	0.75	0.68	0.64
12	(305)	1.00	0.91	0.84		1.00	1.00	0.65	0.63	0.61	0.87	0.67	0.54		1.00	1.00	0.78	0.71	0.67
14	(356)	1.00	0.97	0.90			1.00	0.68	0.65	0.63	1.00	0.84	0.68			1.00	0.84	0.77	0.72
16	(406)	1.00	1.00	0.95				0.70	0.67	0.65		1.00	0.84				0.90	0.82	0.77
18	(457)			1.00				0.73	0.69	0.67			1.00				0.95	0.87	0.82
20	(508)							0.75	0.71	0.68			1.00				1.00	0.92	0.86
24	(610)							0.80	0.76	0.72								1.00	0.94
30	(762)							0.88	0.82	0.78									1.00
36	(914)							0.95	0.88	0.83									
> 48	(1219)							1.00	1.00	0.94									

1 Linear interpolation not permitted.

2 When combining multiple load adjustment factors (e.g. for a 4 anchor pattern in a corner with thin concrete member) the design can become very conservative. To optimize the design, use Hilti PROFIS Anchor Design software or perform anchor calculation using design equations from ACI 318-14 Chapter 17.

3 Spacing factor reduction in shear, f_{AV}, assumes an influence of a nearby edge. If no edge exists, then $f_{AV} = f_{AN}$.

4 Concrete thickness reduction factor in shear, f_{HV}, assumes an influence of a nearby edge. If no edge exists, then f_{HV} = 1.0.

If a reduction factor value is in a shaded cell, it may not be permitted if both edge and spacing are less than “critical” distances.
Check table 5 and figure 2 of this section to calculate permissable edge distance, spacing and concrete thickness combinations.
For the HSL-3-SH M8, M10 and M12 diameters, the minimum slab thickness must be increased by 5 mm (3/16-in.).

DESIGN INFORMATION IN CONCRETE PER CSA A23.3

Limit State Design of anchors is described in the provisions of CSA A23.3-14 Annex D for post-installed anchors tested and assessed in accordance with ACI 355.2 for mechanical anchors and ACI 355.4 for adhesive anchors. This section contains the Limit State Design tables with unfactored characteristic loads that are based on the published loads in ICC Evaluation Services ESR-1545. These tables are followed by factored resistance tables. The factored resistance tables have characteristic design loads that are prefactored by the applicable reduction factors for a single anchor with no anchor-to-anchor spacing or edge distance adjustments for the convenience of the user of this document. All the figures in the previous ACI 318-14 Chapter 17 design section are applicable to Limit State Design and the tables will reference these figures.

For a detailed explanation of the tables developed in accordance with CSA A23.3-14 Annex D, refer to Section 3.1.8. Technical assistance is available by contacting Hilti Canada at (800) 363-4458 or at www.hilti.com.

Table 10 - Steel strength for Hilti HSL-3 anchors[1,2]

Nominal anchor diameter	HSL-3, HSL-3-B, HSL-3-SK, HSL-3-SH			HSL-3-G		
	Tensile N_{sar} [3] lb (kN)	Shear V_{sar} [4] lb (kN)	Seismic shear $V_{sar,eq}$ [5] lb (kN)	Tensile N_{sar} [3] lb (kN)	Shear V_{sar} [4] lb (kN)	Seismic shear $V_{sar,eq}$ [5] lb (kN)
M8	4,495 (20.0)	4,615 (20.5)	2,940 (13.1)	4,495 (20.0)	3,870 (17.2)	2,410 (10.7)
M10	7,100 (31.6)	6,520 (29.0)	5,390 (24.0)	7,100 (31.6)	5,345 (23.8)	4,415 (19.6)
M12	10,335 (46.0)	9,385 (41.7)	7,580 (33.7)	10,335 (46.0)	7,755 (34.5)	6,265 (27.9)
M16	19,170 (85.3)	17,025 (75.7)	15,805 (70.3)	19,170 (85.3)	14,460 (64.3)	13,430 (59.7)
M20	29,975 (133.3)	25,195 (112.1)	18,575 (82.6)	29,975 (133.3)	21,140 (94.0)	15,595 (69.4)
M24	43,145 (191.9)	29,295 (130.3)	24,335 (108.2)	na	na	na

1 See section 3.1.8 to convert design strength value to ASD value.
2 Hilti HSL-3 anchors are to be considered ductile steel elements.
3 Tensile $N_{sar} = A_{se,N}\, \phi_s\, f_{uta}\, R$ as noted in CSA A23.3-14 Annex D.
4 Shear determined by static shear tests with $V_{sar} < A_{se,V}\, \phi_s\, 0.6\, f_{uta}\, R$ as noted in CSA A23.3-14 Annex D.
5 Seismic shear values determined by seismic shear tests with $V_{sar,eq} < A_{se,V}\, \phi_s\, 0.6\, f_{uta}\, R$ as noted in CSA A23.3-14 Annex D. See Section 3.1.8 for additional information on seismic applications.

Table 11 - Hilti HSL-3 design information in accordance with CSA A23.3-14 Annex D[1]

Design parameter	Symbol	Units	Nominal anchor diameter M8	M10	M12	M16	M20	M24	Ref A23.3-14
Anchor O.D.	d_a	mm (in.)	12 (0.47)	15 (0.59)	18 (0.71)	24 (0.94)	28 (1.10)	32 (1.26)	
Effective minimum embedment[2]	h_{ef}	mm (in.)	60 (2.4)	70 (2.8)	80 (3.1)	100 (3.9)	125 (4.9)	150 (5.9)	
Minimum concrete thickness	h_{min}	mm (in.)	See table 5						
Critical edge distance	c_{ac}	mm (in.)	See table 5						
Minimum edge distance	c_{min}	mm (in.)	See table 5						
	for s >	mm (in.)	See table 5						
Minimum anchor spacing	s_{min}	mm (in.)	See table 5						
	for c >	mm (in.)	See table 5						
Minimum hole depth in concrete	h_o	mm (in.)	80 (3.1)	90 (3.5)	105 (4.1)	125 (4.9)	155 (6.1)	190 (7.5)	
Minimum specified yield strength	f_{ya}	N/mm² (psi)	641 (93,000)						
Minimum specified ultimate strength	f_{uta}	N/mm² (psi)	800 (116,000)						
Effective tensile stress area	$A_{se,N}$	mm² (in²)	36.8 (0.057)	58.1 (0.090)	84.5 (0.131)	156.8 (0.243)	245.2 (0.380)	352.9 (0.547)	
Steel embed. material resistance factor for reinforcement	ϕ_s	-	0.85						8.4.3
Resistance modification factor for tension, steel failure modes[3]	R	-	0.80						D.5.3
Resistance modification factor for shear, steel failure modes[3]	R	-	0.75						D.5.3
Factored steel resistance in tension	N_{sar}	lb (kN)	4,495 (20.0)	7,100 (31.6)	10,335 (46.0)	19,170 (85.3)	29,975 (133.3)	43,145 (191.9)	D.6.1.2
Factored steel resistance in shear HSL-3, HSL-B, HSL-3-SK, HSL-3-SH	V_{sar}	lb (kN)	4,615 (20.5)	6,520 (29.0)	9,385 (41.7)	17,025 (75.7)	25,195 (112.1)	29,295 (130.3)	D.7.1.2
Factored steel resistance in shear HSL-3-G	V_{sar}	lb (kN)	3,870 (17.2)	5,345 (23.8)	7,755 (34.5)	14,460 (64.3)	21,140 (94.0)	NA	D.7.1.2
Factored steel resistance in shear, seismic HSL-3, HSL-B, HSL-3-SK, HSL-3-SH	$V_{sar,eq}$	lb (kN)	2,940 (13.1)	5,390 (24.0)	7,580 (33.7)	15,805 (70.3)	18,575 (82.6)	24,335 (108.3)	
Factored steel resistance in shear, seismic HSL-3-G	$V_{sar,eq}$	lb (kN)	2,410 (10.7)	4,415 (19.6)	6,265 (27.9)	13,430 (59.7)	15,595 (69.4)	NA	
Coeff. for factored conc. breakout resistance, uncracked concrete	$k_{c,uncr}$	-	10						D.6.2.2
Coeff. for factored conc. breakout resistance, cracked concrete	$k_{c,cr}$	-	7	10					D.6.2.2
Modification factor for anchor resistance, tension, uncracked concrete[4]	$\psi_{c,N}$	-	1.0						D.6.2.6
Anchor category	-	-	1.0						D.5.3 (c)
Concrete material resistance factor	ϕ_c	-	0.65						8.4.2
Resistance modification factor for tension and shear, concrete failure modes, Condition B[5]	R	-	1.0						D.5.3 (c)
Factored pullout resistance in 20 MPa uncracked concrete[6]	$N_{pr,uncr}$	lb (kN)	2,945 (13.1)	NA	NA	NA	NA	NA	D.6.3.2
Factored pullout resistance in 20 MPa cracked concrete[6]	$N_{pr,cr}$	lb (kN)	1,970 (8.8)	3,150 (14.0)	NA	NA	NA	NA	D.6.3.2
Factored seismic pullout resistance in 20 MPa cracked concrete[6]	$N_{pr,eq}$	lb (kN)	1,970 (8.8)	3,150 (14.0)	NA	NA	NA	10,030 (44.6)	
Load bearing length of anchor in shear	ℓ_e	mm (in.)	24 (0.94)	30 (1.18)	36 (1.42)	48 (1.89)	56 (2.20)	64 (2.52)	D.7.2.2

1 Design information in this table is taken from ICC-ES ESR-1545, dated March, 2016, table 3, and converted for use with CSA A23.3-14 Annex D.
2 See figure 1 of this section.
3 The HSL-3 is considered a ductile steel element as defined by CSA A23.3-14 Annex D section D.2.
4 For all design cases, $\psi_{c,N}$ = 1.0. The appropriate coefficient for breakout resistance for cracked concrete ($k_{c,cr}$) or uncracked concrete ($k_{c,uncr}$) must be used.
5 For use with the load combinations of CSA A23.3-14 chapter 8. Condition B applies where supplementary reinforcement in conformance with CSA A23.3-14 section D.5.3 is not provided, or where pullout or pryout strength governs. For cases where the presence of supplementary reinforcement can be verified, the resistance modification factors associated with Condition A may be used.
6 For all design cases, $\psi_{c,P}$ = 1.0. NA (not applicable) denotes that this value does not control for design. See section 4.1.4 of ESR-1545 for additional information.

Table 12 - Hilti HSL-3 anchors factored resistance with concrete/pullout failure in uncracked concrete[1,2,3,4,5]

Nominal anchor diameter	Effective embed. in. (mm)	Tension - N_r				Shear - V_r			
		f'_c = 20 MPa (2,900psi) lb (kN)	f'_c = 25 MPa (3,625 psi) lb (kN)	f'_c = 30 MPa (4,350 psi) lb (kN)	f'_c = 40 MPa (5,800 psi) lb (kN)	f'_c = 20 MPa (2,900 psi) lb (kN)	f'_c = 25 MPa (3,625 psi) lb (kN)	f'_c = 30 MPa (4,350 psi) lb (kN)	f'_c = 40 MPa (5,800 psi) lb (kN)
M8	60 (2.4)	2,945 (13.1)	3,290 (14.6)	3,605 (16.0)	4,165 (18.5)	3,035 (13.5)	3,395 (15.1)	3,720 (16.5)	4,295 (19.1)
M10	70 (2.8)	3,825 (17.0)	4,280 (19.0)	4,685 (20.9)	5,415 (24.1)	7,655 (34.0)	8,560 (38.1)	9,375 (41.7)	10,825 (48.2)
M12	80 (3.1)	4,675 (20.8)	5,230 (23.3)	5,725 (25.5)	6,615 (29.4)	9,350 (41.6)	10,455 (46.5)	11,455 (50.9)	13,225 (58.8)
M16	100 (3.9)	6,535 (29.1)	7,305 (32.5)	8,005 (35.6)	9,240 (41.1)	13,070 (58.1)	14,615 (65.0)	16,005 (71.2)	18,485 (82.2)
M20	125 (4.9)	9,135 (40.6)	10,210 (45.4)	11,185 (49.8)	12,915 (57.5)	18,265 (81.3)	20,420 (90.8)	22,370 (99.5)	25,830 (114.9)
M24	150 (5.9)	12,005 (53.4)	13,425 (59.7)	14,705 (65.4)	16,980 (75.5)	24,010 (106.8)	26,845 (119.4)	29,405 (130.8)	33,955 (151.0)

Table 13 - Hilti HSL-3 anchor steel factored resistance with concrete / pullout failure in cracked concrete[1,2,3,4,5]

Nominal anchor diameter	Effective embed. in. (mm)	Tension - N_r				Shear - V_r			
		f'_c = 20 MPa (2,900psi) lb (kN)	f'_c = 25 MPa (3,625 psi) lb (kN)	f'_c = 30 MPa (4,350 psi) lb (kN)	f'_c = 40 MPa (5,800 psi) lb (kN)	f'_c = 20 MPa (2,900 psi) lb (kN)	f'_c = 25 MPa (3,625 psi) lb (kN)	f'_c = 30 MPa (4,350 psi) lb (kN)	f'_c = 40 MPa (5,800 psi) lb (kN)
M8	60 (2.4)	1,970 (8.8)	2,200 (9.8)	2,410 (10.7)	2,785 (12.4)	2,125 (9.5)	2,375 (10.6)	2,605 (11.6)	3,005 (13.4)
M10	70 (2.8)	3,150 (14.0)	3,520 (15.7)	3,855 (17.2)	4,455 (19.8)	7,655 (34.0)	8,560 (38.1)	9,375 (41.7)	10,825 (48.2)
M12	80 (3.1)	4,675 (20.8)	5,230 (23.3)	5,725 (25.5)	6,615 (29.4)	9,350 (41.6)	10,455 (46.5)	11,455 (50.9)	13,225 (58.8)
M16	100 (3.9)	6,535 (29.1)	7,305 (32.5)	8,005 (35.6)	9,240 (41.1)	13,070 (58.1)	14,615 (65.0)	16,005 (71.2)	18,485 (82.2)
M20	125 (4.9)	9,135 (40.6)	10,210 (45.4)	11,185 (49.8)	12,915 (57.5)	18,265 (81.3)	20,420 (90.8)	22,370 (99.5)	25,830 (114.9)
M24	150 (5.9)	12,005 (53.4)	13,425 (59.7)	14,705 (65.4)	16,980 (75.5)	24,010 (106.8)	26,845 (119.4)	29,405 (130.8)	33,955 (151.0)

1 See section 3.1.8 to convert design strength value to ASD value.
2 Linear interpolation between embedment depths and concrete compressive strengths is not permitted.
3 Apply spacing, edge distance, and concrete thickness factors in tables 6 to 9 as necessary. Compare to the steel values in table 10. The lesser of the values is to be used for the design.
4 Tabular values are for normal weight concrete only. For lightweight concrete multiply design strength by λ_a as follows: for sand-lightweight, λ_a = 0.68; for all-lightweight, λ_a = 0.60
5 Tabular values are for static loads only. Seismic design is not permitted for uncracked concrete. For seismic tension loads, multiply cracked concrete tabular values in tension only by the following reduction factors:
M24 - $\alpha_{N,seis}$ = 0.62
All other sizes - $\alpha_{N,seis}$ = 0.75
No reduction needed for seismic shear. See section 3.1.8 for additional information on seismic applications.

INSTALLATION INSTRUCTIONS

Installation Instructions For Use (IFU) are included with each product package. They can also be viewed or downloaded online at www.hilti.com. Because of the possibility of changes, always verify that downloaded IFU are current when used. Proper installation is critical to achieve full performance. Training is available on request. Contact Hilti Technical Services for applications and conditions not addressed in the IFU.

ORDERING INFORMATION

HSL-3 bolt version

Description	Box qty
HSL-3 M 8/20	40
HSL-3 M 8/40	40
HSL-3 M 10/20	20
HSL-3 M 10/40	20
HSL-3 M 12/25	20
HSL-3 M 12/50	20
HSL-3 M 16/25	10
HSL-3 M 16/50	10
HSL-3 M 20/30	6
HSL-3 M 20/60	6
HSL-3 M 24/30	4
HSL-3 M 24/60	4

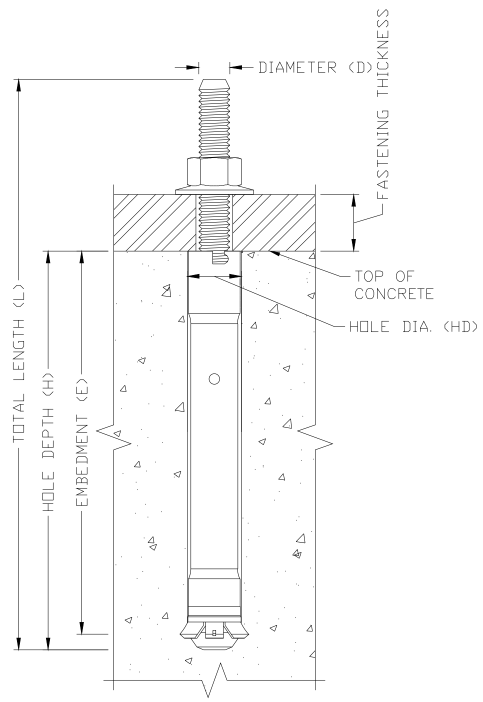
HSL-3-B torque cap

Description	Box qty
HSL-3-B M 12/5	20
HSL-3-B M 12/25	20
HSL-3-B M 12/50	10
HSL-3-B M 16/10	10
HSL-3-B M 16/25	10
HSL-3-B M 20/30	6
HSL-3-B M 24/30	4

HSL-3-SK Countersunk and
HSL-3-SH Hex Socket Head Screw
versions available by special order.

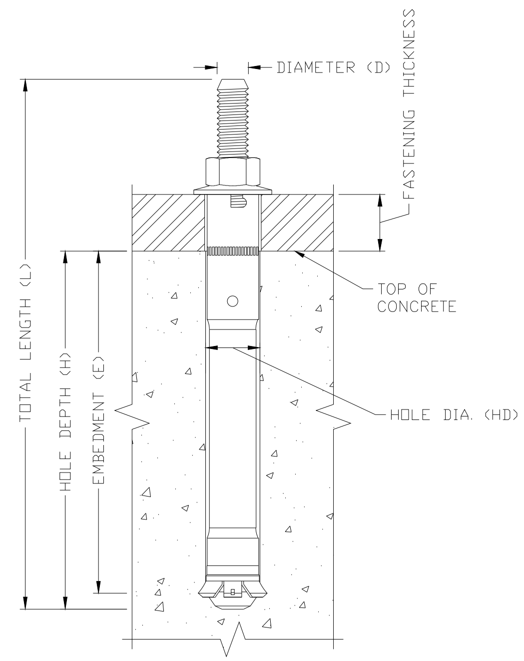
HSL-3-G stud version

Description	Box qty
HSL-3-G M 8/20	40
HSL-3-G M 10/20	20
HSL-3-G M 12/25	20
HSL-3-G M 12/50	10
HSL-3-G M 16/25	10
HSL-3-G M 16/50	10
HSL-3-G M 20/30	6
HSL-3-G M 20/60	6



HILTI HDA-P

(SEE SCHEDULE)



HILTI HDA-T

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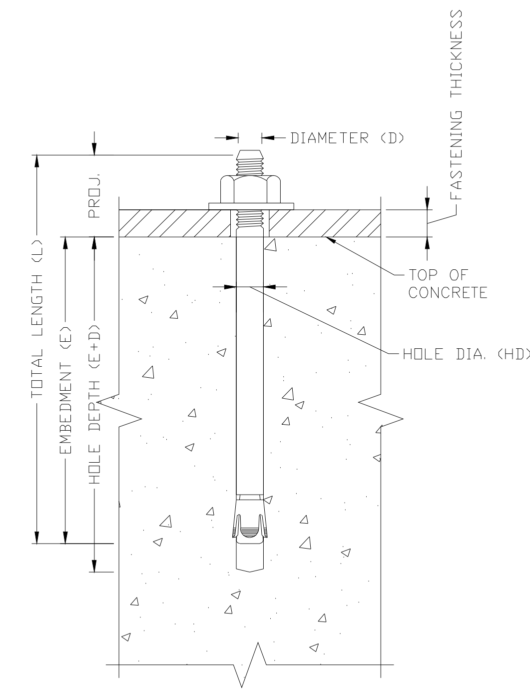
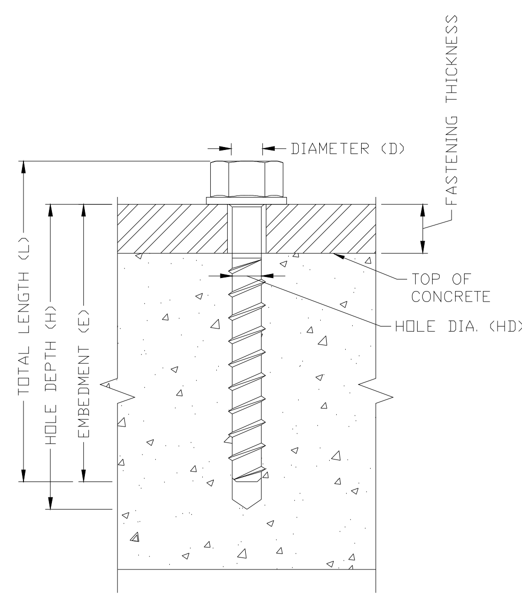


HILTI KWIK BOLT 3 / KWIK BOLT TZ

(SEE SCHEDULE)



HILTI KWIK HUS-EZ

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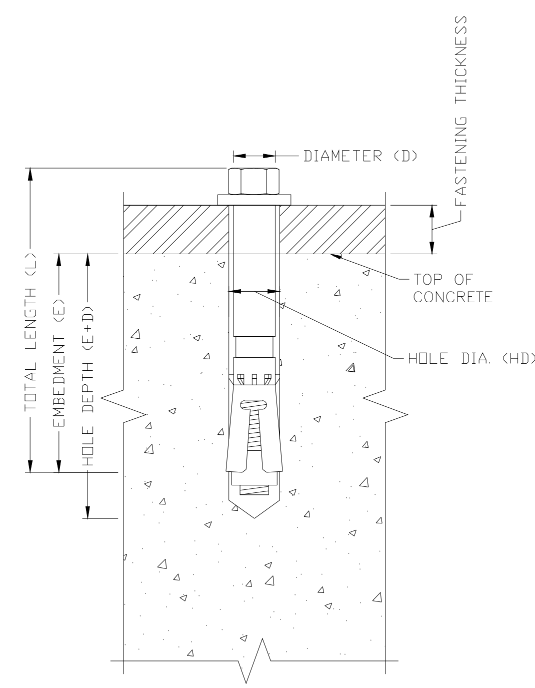

HILTI HSL-3

(SEE SCHEDULE)

GENERAL NOTES FOR POST-INSTALLED ANCHORS

1)EXCEPT WHERE INDICATED ON THE DRAWINGS, POST-INSTALLED ANCHORS SHALL CONSIST OF THE FOLLOWING ANCHOR TYPES AS PROVIDED BY HILTI, INC. CONTACT HILTI AT (800) 879-8000 FOR PRODUCT RELATED QUESTIONS.

a)ANCHORAGE TO CONCRETE

i) ADHESIVE ANCHORS FOR CRACKED AND UNCRACKED CONCRETE USE:
- (1) HILTI HIT-HY 200 SAFE SET SYSTEM WITH THE HILTI HIT-Z ROD PER ICC ESR-3187
- (2) HILTI HIT-HY 200 SAFE SET SYSTEM WITH HILTI HOLLOW DRILL BIT (TE-CD OR TE-YD) AND VC 150/300 VACUUM (VC 20/40) SYSTEM WITH HAS-E THREADED ROD PER ICC ESR-3187
- (3) HILTI HIT-RE 500 V3 SAFE SET SYSTEM WITH HILTI HOLLOW DRILL BIT (TE-CD OR TE-YD) AND VC 150/300 VACUUM (VC 20/40) WITH HAS-E THREADED ROD PER ICC ESR-3814
- (4) HILTI HIT-RE 500 V3 SAFE SET SYSTEM WITH HILTI ROUGHENING TOOL (TE-YRT) WITH HAS-E THREADED ROD PER ICC ESR-3814 FOR DIAMOND CORED HOLES

ii)MEDIUM DUTY MECHANICAL ANCHORS FOR CRACKED AND UNCRACKED CONCRETE USE:
- (1) HILTI KWIK HUS-EZ, KWIK HUS-EZ I, KWIK HUS-EZ P, AND KWIK HUS-EZ E SCREW ANCHORS PER ICC ESR-3027.
- (2) HILTI KWIK BOLT-TZ EXPANSION ANCHORS PER ICC ESR-1917
- (3) HILTI KWIK BOLT-TZ EXPANSION ANCHORS DIAMETERS 3/8", 1/2" AND 5/8" WITH HILTI ADAPTIVE TORQUE SYSTEM (SIW-6AT-A22 Impact Wrench Tool body and SI-AT-A22 Adaptive Torque Module) PER ICC ESR-1917
- (4) HILTI KWIK BOLT 3 EXPANSION ANCHORS (UNCRACKED CONCRETE ONLY) PER ICC ESR-2302
- (5) HILTI KWIK BOLT 3 EXPANSION ANCHORS DIAMETERS 3/8", 1/2" AND 5/8" WITH HILTI ADAPTIVE TORQUE SYSTEM (SIW-6AT-A22 Impact Wrench Tool body and SI-AT-A22 Adaptive Torque Module) (UNCRACKED CONCRETE ONLY) PER ICC ESR-2302

iii) HEAVY DUTY MECHANICAL ANCHORS FOR CRACKED AND UNCRACKED CONCRETE USE:
- (1) HILTI HDA UNDERCUT ANCHORS PER ICC ESR 1546
- (2) HILTI HSL-3 EXPANSION ANCHORS PER ICC ESR 1545

b)REBAR DOWELING INTO CONCRETE

i) ADHESIVE ANCHORS FOR CRACKED AND UNCRACKED CONCRETE USE:
- (1) HILTI HIT-HY 200 SAFE SET SYSTEM WITH HILTI HOLLOW DRILL BIT (TE-CD OR TE-YD) AND VC 150/300 VACUUM (VC 20/40) SYSTEM WITH CONTINUOUSLY DEFORMED REBAR PER ICC ESR-3187
- (2) HILTI HIT-HY 500 V3 SAFE SET SYSTEM WITH HILTI HOLLOW DRILL BIT (TE-CD OR TE-YD) AND VC 150/300 VACUUM (VC 20/40) SYSTEM WITH CONTINUOUSLY DEFORMED REBAR PER ICC ESR-3814
- (3) HILTI HIT-RE 500 V3 SAFE SET SYSTEM WITH HILTI ROUGHENING TOOL (TE-YRT) WITH CONTINUOUSLY DEFORMED REBAR PER ICC ESR-3814 IN DIAMOND CORED HOLES

c)ANCHORAGE TO SOLID GROUTED MASONRY

i) ADHESIVE ANCHORS USE:
- (1) HILTI HIT-HY 270 MASONRY ADHESIVE ANCHORING SYSTEM PER ICC ESR-4143.
- (2) STEEL ANCHOR ELEMENT SHALL BE HILTI HAS-E CONTINUOUSLY THREADED ROD OR CONTINUOUSLY DEFORMED STEEL REBAR

ii)MECHANICAL ANCHORS USE:
- (1) HILTI KWIK BOLT-3 EXPANSION ANCHORS PER ICC ESR 1385

d)ANCHORAGE TO HOLLOW / MULTI-WYTHE MASONRY

i) ADHESIVE ANCHORS USE:
- (1) HILTI HIT-HY 270 MASONRY ADHESIVE ANCHORING SYSTEM PER ICC ESR-4144.
- (2) STEEL ANCHOR ELEMENT SHALL BE HILTI HAS-E CONTINUOUSLY THREADED ROD OR CONTINUOUSLY DEFORMED STEEL REBAR
- (3) THE APPROPRIATE SIZE SCREEN TUBE SHALL BE USED PER ADHESIVE MANUFACTURER'S RECOMMENDATION

2)ANCHOR CAPACITY USED IN DESIGN SHALL BE BASED ON THE TECHNICAL DATA PUBLISHED BY HILTI OR SUCH OTHER METHOD AS APPROVED BY THE STRUCTURAL ENGINEER OF RECORD. SUBSTITUTION REQUESTS FOR ALTERNATE PRODUCTS MUST BE APPROVED IN WRITING BY THE STRUCTURAL ENGINEER OF RECORD PRIOR TO USE. CONTRACTOR SHALL PROVIDE CALCULATIONS DEMONSTRATING THAT THE SUBSTITUTED PRODUCT IS CAPABLE OF ACHIEVING THE PERFORMANCE VALUES OF THE SPECIFIED PRODUCT. SUBSTITUTIONS WILL BE EVALUATED BY THEIR HAVING AN ICC ESR/ESL SHOWING COMPLIANCE WITH THE RELEVANT BUILDING CODE FOR SEISMIC USES, LOAD RESISTANCE, INSTALLATION CATEGORY, AND AVAILABILITY OF COMPREHENSIVE INSTALLATION INSTRUCTIONS. ADHESIVE ANCHOR EVALUATION WILL ALSO CONSIDER CREEP, IN-SERVICE TEMPERATURE AND INSTALLATION TEMPERATURE.

3)INSTALL ANCHORS PER THE MANUFACTURER INSTRUCTIONS, AS INCLUDED IN THE ANCHOR PACKAGING.

4)OVERHEAD ADHESIVE ANCHORS MUST BE INSTALLED USING THE HILTI PROFI SYSTEM.

5)THE CONTRACTOR SHALL ARRANGE AN ANCHOR MANUFACTURER'S REPRESENTATIVE TO PROVIDE ONSITE INSTALLATION TRAINING FOR ALL OF THEIR ANCHORING PRODUCTS SPECIFIED. THE STRUCTURAL ENGINEER OF RECORD MUST RECEIVE DOCUMENTED CONFIRMATION THAT ALL OF THE CONTRACTOR'S PERSONNEL WHO INSTALL ANCHORS ARE TRAINED PRIOR TO THE COMMENCEMENT OF INSTALLING ANCHORS.

6)ANCHOR CAPACITY IS DEPENDANT UPON SPACING BETWEEN ADJACENT ANCHORS AND PROXIMITY OF ANCHORS TO EDGE OF CONCRETE. INSTALL ANCHORS IN ACCORDANCE WITH SPACING AND EDGE CLEARANCES INDICATED ON THE DRAWINGS.

7)EXISTING REINFORCING BARS IN THE CONCRETE STRUCTURE MAY CONFLICT WITH SPECIFIC ANCHOR LOCATIONS. UNLESS NOTED ON THE DRAWINGS THAT THE BARS CAN BE CUT, THE CONTRACTOR SHALL REVIEW THE EXISTING STRUCTURAL DRAWINGS AND SHALL UNDERTAKE TO LOCATE THE POSITION OF THE REINFORCING BARS AT THE LOCATIONS OF THE CONCRETE ANCHORS, BY HILTI FERROSCAN, HILTI PS 1000, GPR, X-RAY, CHIPPING OR OTHER APPROVED MEANS.

CONTRACT NO	DWG NO	REV.	SCALE:

REFERENCE DRAWINGS

DWG NO	TITLE	DWG NO	TITLE

NO	REVISION	BY	CHK	APP	DATE	NO	REVISION	BY	CHK	APP	DATE

DRAWN: DATE:

CHECKED:

APPROVED:

APPROVED:

SEAL:

DWG TITLE