3.3.8.1 Product description

The KWIK Bolt 3 (KB3) is a torque controlled expansion anchor, which provides consistent performance for a wide range of mechanical anchor applications. This anchor series is available in carbon steel with zinc electroplated coating, carbon steel with hot-dip galvanized coating, 304 stainless steel and 316 stainless steel versions.The threaded stud version of the anchor is available in a variety of diameters ranging from 1/4- to 1-in. depending on the steel and coating type. Applicable base materials include normal-weight concrete, structural lightweight concrete, lightweight concrete over metal deck, and grout-filled concrete masonry.

Product features

- Length identification code facilitates quality control and inspection after installation.
- Through fixture installation and variable thread lengths improve productivity and accommodate various base plate thicknesses.
- Raised impact section (Dog Point) prevents thread damage during installation.
- Anchor size is same as drill bit size for easy installation. For temporary applications anchors may be driven into drilled holes after usage.
- Mechanical expansion allows immediate load application.

Guide specifications

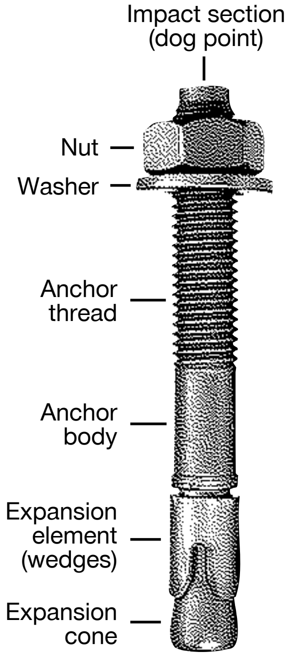
Torque-controlled expansion anchor shall be Hilti KWIK Bolt 3. KWIK Bolt 3 anchors meet the description of Federal Specification A-A 1923A, Type 4. The anchor bears a length identification mark embossed on the impact section (dog point) of the anchor identifying the anchor as a Hilti KWIK Bolt 3.

Carbon steel Kwik Bolt 3 anchors have a carbon steel anchor body, carbon steel nut and carbon steel washer. Anchor body, nut and washer have zinc plating conforming to ASTM B633 with a minimum thickness of 5 µm.

AISI Type 304 stainless steel Kwik Bolt 3 anchors have an anchor body, nut and washer That conform to AISI Type 304. The expansion wedges conform to either AISI Type 304 stainless steel or either AISI Type 316 stainless steel.

AISI Type 316 stainless steel Kwik Bolt 3 anchors have an anchor body, nut and washer That conform to AISI Type 316. The expansion wedges conform to AISI Type 316 stainless steel.

Hot-dip galvanized Kwik Bolt 3 anchors have a carbon steel anchor body, carbon steel nut and carbon steel washer. Anchor body, nut and washer have zinc plating conforming to ASTM A153 with an average thickness of 53 µm. The expansion wedges conform to either AISI Type 304 stainless steel or either AISI Type 316 stainless steel.



Listings/Approvals

ICC-ES (International Code Council)
ESR-2302

ICC-ES (International Code Council)
ESR-1385 Grout-filled concrete masonry

City of Los Angeles
Research Report No. 25577
Research Report No. 25577M for masonry

FM (Factory Mutual)
Pipe Hanger Components for Automatic Sprinkler for 3/8 through 3/4

UL LLC
UL 203 Pipe Hanger Equipment for Fire Protection Services for 3/8 through 3/4

Qualified under an NQA-1 Nuclear Quality Program

*Please refer to the reports to verify that the type and diameter specified is included

Independent code evaluation

IBC® / IRC® 2012
IBC® / IRC® 2009
IBC® / IRC® 2006
IBC® / IRC® 2003

3.3.8 KWIK Bolt 3 Expansion Anchor

3.3.8.2 Material specifications

Carbon steel with electroplated zinc

All carbon steel KWIK Bolt 3 and Rod Coupling Anchors, excluding the 3/4 x 12 and 1-inch diameter sizes, have the tensile bolt fracture loads shown in table 1.

All carbon steel 3/4 x 12 and 1 inch diameter sizes and carbon steel KWIK Bolt 3 Countersunk anchor bodies have mechanical properties as listed in table 1.

Carbon steel anchor components plated in accordance with ASTM B633 to a minimum thickness of 5 μm.

Nuts conform to the requirements of ASTM A563, Grade A, Hex.

Washers meet the requirements of ASTM F844.

Expansion wedges are manufactured from carbon steel, except the following anchors have stainless steel wedges:

- All 1/4-inch diameter anchors
- 3/4x12
- All 1-inch diameter anchors
- All KWIK Bolt 3 Countersunk

Carbon steel with hot-dip galvanized plating

Anchor bodies manufactured from carbon steel have the tensile bolt fracture loads shown in table 1.

Carbon steel anchor components have an average zinc plating thickness greater than 53 μm according to ASTM A153, Class C.

Nuts conform to the requirements of ASTM A563, Grade A, Hex.

Washers meet the requirements of ASTM F844.

Stainless steel expansion wedges are manufactured from either AISI Type 304 or Type 316.

Stainless steel

Anchor bodies smaller than 3/4-inch, excluding all KWIK Bolt 3 Countersunk, are produced from AISI Type 304 or Type 316 stainless steel having the bolt fracture loads shown in table 1.

Anchor bodies 3/4-inch and larger, and all stainless steel KWIK Bolt 3 Countersunk anchor bodies, are produced from AISI Type 304 or Type 316 stainless steel having the mechanical properties shown in table 1.

Nuts meet the dimensional requirements of ASTM F594.

Washers meet the dimensional requirements of ANSI B18.22.1, Type A, plain.

Stainless steel expansion wedges for AISI Type 304 are made from either AISI Type 304 or Type 316. Stainless steel expansion wedges for AISI Type 316 anchors are made from type 316. All stainless steel nuts and washers for AISI Type 304 or Type 316 anchors are manufactured from AISI Type 304 or 316, respectively.

Table 1 - KWIK Bolt 3 Bolt fracture load (lb)[1]

Nominal anchor diameter	Carbon steel	Hot-dip galvanized	Stainless steel
1/4	2,900	no offering	2,900
3/8	7,200	no offering	7,200
1/2	12,400	12,400	12,400
5/8	19,600	19,600	21,900
3/4	28,700	28,700	$f_{uta} \geq 76$, $f_{ya} \geq 64$[2]
1	$f_{uta} \geq 88$, $f_{ya} \geq 75$[2]	no offering	$f_{uta} \geq 76$, $f_{ya} \geq 64$[2]

[1] Bolt fracture loads are determined by testing in a universal tensile machine for quality control at the manufacturing facility. These loads are not intended for design use. See tables 4 and 12 for the steel design strengths of carbon steel and stainless steel, respectively.

[2] All 3/4-in. stainless steel, 3/4x12 carbon steel, all 1-in. carbon steel and all 1-in. stainless steel material strengths specified by the tensile and yield strengths expressed in (ksi). Bolt fracture loads not applicable for these models.

3.3.8.3.1 Technical data for concrete

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-2302 and the equations within ACI 318-11 Appendix D. For a detailed explanation of the Hilti Simplified Design Tables, refer to section 3.1.7. Data tables from ESR-2302 are not contained in this section, but can be found at www.icc-es.org or at www.us.hilti.com.

Allowable Stress Design or ASD technical information and data tables can be found at www.us.hilti.com.

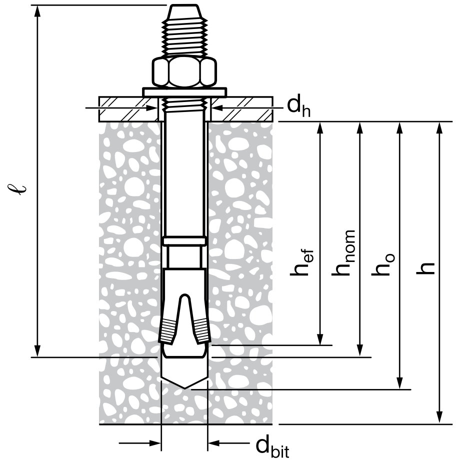


Figure 1 - KWIK Bolt 3 installation

Table 2 - Carbon Steel KWIK Bolt 3 specifications

Setting information	Symbol	Units	Nominal anchor diameter									
			1/4	3/8	1/2		5/8		3/4		1	
Drill bit dia.	d_{bit}		1/4	3/8	1/2		5/8		3/4		1	
Minimum nominal embedment	h_{nom}	in.	1-3/4	2-3/8	2-1/4	3-5/8	3-1/2	4-3/8	4-1/4	5-5/8	4-5/8	6-3/8
		(mm)	(44)	(60)	(57)	(92)	(89)	(111)	(108)	(143)	117	162
Minimum effective embedment	h_{ef}	in.	1-1/2	2	2	3-1/4	3-1/8	4	3-3/4	5	4	5-3/4
		(mm)	(38)	(51)	(51)	(83)	(79)	(102)	(95)	(127)	(102)	(146)
Minimum hole depth	h_o	in.	2	2-5/8	2-5/8	4	3-7/8	4-3/4	4-1/2	5-3/4	5	6-3/4
		(mm)	(51)	(67)	(67)	(102)	(98)	(121)	(114)	(146)	(127)	(171)
Fixture hole diameter	d_h	in.	5/16	7/16	9/16		11/16		13/16		1-1/8	
Anchor length	ℓ		See ordering information									
Installation torque	T_{inst}	ft-lb	4	20	40		60		110		150	
		(Nm)	(5)	(27)	(54)		(81)		(149)		(203)	
Wrench size		in.	7/16	9/16	3/4		15/16		1-1/8		1-1/2	

3.3.8 KWIK Bolt 3 Expansion Anchor

Table 3 - Hilti KWIK Bolt 3 carbon steel design strength with concrete / pullout failure in uncracked concrete[1,2,3,4]

Nominal anchor diameter	Effective embed. in. (mm)	Nominal embed. in. (mm)	Tension - ϕN_n				Shear - ϕV_n			
			f'_c = 2500 psi lb (kN)	f'_c = 3000 psi lb (kN)	f'_c = 4000 psi lb (kN)	f'_c = 6000 psi lb (kN)	f'_c = 2500 psi lb (kN)	f'_c = 3000 psi lb (kN)	f'_c = 4000 psi lb (kN)	f'_c = 6000 psi lb (kN)
1/4	1-1/2 (38)	1-3/4 (44)	1,025 (4.6)	1,080 (4.8)	1,180 (5.2)	1,330 (5.9)	1,545 (6.9)	1,690 (7.5)	1,950 (8.7)	2,390 (10.6)
3/8	2 (51)	2-3/8 (60)	2,205 (9.8)	2,415 (10.7)	2,790 (12.4)	3,420 (15.2)	2,375 (10.6)	2,605 (11.6)	3,005 (13.4)	3,680 (16.4)
1/2	2 (51)	2-1/4 (57)	2,205 (9.8)	2,415 (10.7)	2,790 (12.4)	3,420 (15.2)	2,375 (10.6)	2,605 (11.6)	3,005 (13.4)	3,680 (16.4)
	3-1/4 (83)	3-1/2 (89)	4,420 (19.7)	4,840 (21.5)	5,590 (24.9)	6,845 (30.4)	9,845 (43.8)	10,785 (48.0)	12,450 (55.4)	15,250 (67.8)
5/8	3-1/8 (79)	3-1/2 (89)	4,310 (19.2)	4,720 (21.0)	5,450 (24.2)	6,675 (29.7)	9,280 (41.3)	10,165 (45.2)	11,740 (52.2)	14,380 (64.0)
	4 (102)	4-3/8 (111)	6,240 (27.8)	6,835 (30.4)	7,895 (35.1)	9,665 (43.0)	13,440 (59.8)	14,725 (65.5)	17,000 (75.6)	20,820 (92.6)
3/4	3-3/4 (95)	4-1/4 (108)	5,665 (25.2)	6,205 (27.6)	7,165 (31.9)	8,775 (39.0)	12,200 (54.3)	13,365 (59.5)	15,430 (68.6)	18,900 (84.1)
	5 (127)	5-1/2 (140)	6,880 (30.6)	7,535 (33.5)	8,705 (38.7)	10,660 (47.4)	18,785 (83.6)	20,575 (91.5)	23,760 (105.7)	29,100 (129.4)

1 See section 3.1.7.3 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 10 as necessary. Compare to 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, $\lambda_a = 0.68$; for all-lightweight, $\lambda_a = 0.60$

Table 4 - Steel design strength for Hilti KWIK Bolt 3 carbon steel anchors[1,2]

Nominal anchor diameter	Nominal embedment in. (mm)	Tensile[3] ϕN_{sa} lb (kN)	Shear[4] ϕV_{sa} lb (kN)
1/4	1-3/4 (44)	1,590 (7.1)	1,065 (4.7)
3/8	2-3/8 (60)	4,770 (21.2)	2,905 (12.9)
1/2	2-1/4 (57)	8,745 (38.9)	4,315 (19.2)
	3-1/2 (89)		4,390 (19.5)
5/8	3-1/2 (89)	13,515 (60.1)	7,950 (35.4)
	4-3/8 (111)		
3/4	4-1/4 (108)	19,080 (84.9)	10,180 (45.3)
	5-1/2 (140)		10,785 (48.0)

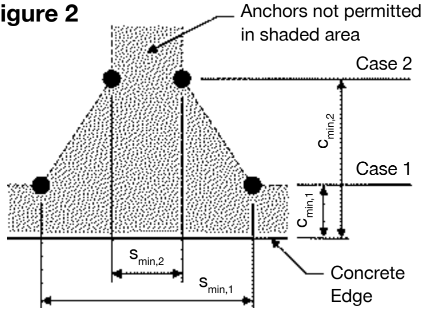
1 See section 3.1.7.3 to convert design strength value to ASD value.

2 KWIK Bolt 3 carbon steel anchors are to be considered ductile steel elements.

3 Tensile $\phi N_{sa} = \phi\ A_{se,N}\ f_{uta}$ as noted in ACI 318 Appendix D.

4 Shear values determined by static shear tests with $\phi V_{sa} < \phi\ 0.60\ A_{se,V}\ f_{uta}$ as noted in ACI 318 Appendix D.

Figure 2



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

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

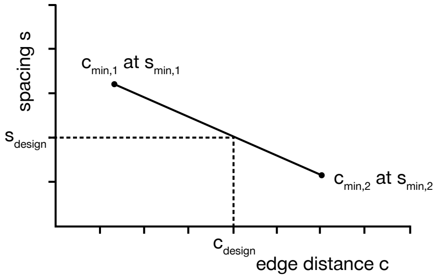


Table 5 - Carbon steel KWIK Bolt 3 installation parameters[1]

Setting information	Symbol	Units	Nominal anchor diameter d_o												
			1/4	3/8		1/2				5/8			3/4		
Effective minimum embedment	h_{ef}	in.	1-1/2	2		2		3-1/4		3-1/8	4		3-3/4		5
		(mm)	(38)	(51)		(51)		(83)		(79)	(102)		(95)		(127)
Minimum member thickness	h_{min}	in.	4	4	5	4	5	6	8	5	6	8	6	8	8
		(mm)	(102)	(102)	(127)	(102)	(127)	(152)	(203)	(127)	(152)	(203)	(152)	(203)	(203)
Case 1	$c_{min,1}$	in.	1-3/8	2	1-1/2	2-1/8	2	1-5/8	1-5/8	2-1/4	1-3/4	1-3/4	2-3/4	2-5/8	2-1/2
		(mm)	(35)	(51)	(38)	(54)	(51)	(41)	(41)	(57)	(44)	(44)	(70)	(67)	(64)
	for $s_{min,1} \geq$	in.	1-3/4	2-7/8	3-1/2	4-7/8	4-3/4	4-1/4	4	5-1/4	4-3/4	4	6-7/8	6-1/2	6-3/8
		(mm)	(44)	(73)	(89)	(124)	(121)	(108)	(102)	(133)	(121)	(102)	(175)	(165)	(162)
Case 2	$c_{min,2}$	in.	1-5/8	2-3/8	2/3/8	2-5/8	2-3/8	2-1/4	2	3-1/8	2-3/8	2-1/4	3-3/4	3-3/8	3-3/8
		(mm)	(41)	(60)	(60)	(67)	(60)	(57)	(51)	(79)	(60)	(57)	(95)	(86)	(86)
	for $s_{min,2} \geq$	in.	1-1/4	1-3/4	1-3/4	2-1/2	2-1/4	2	1-7/8	2-3/8	2-1/8	2-1/8	3-3/4	3-3/8	3-1/4
		(mm)	(32)	(44)	(44)	(64)	(57)	(51)	(48)	(60)	(54)	(54)	(95)	(86)	(83)

[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 spacings.

Table 6 - Load adjustment factors for 1/4-in. diameter KWIK Bolt 3 carbon steel anchor in uncracked concrete[1,2]

1/4-in. KB3 carbon steel 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 edge f_{RV}	Concrete thickness factor in shear[4] f_{HV}
Embedment h_{nom}			1-3/4	1-3/4	1-3/4	1-3/4	1-3/4	1-3/4
Spacing (s) / Edge Distance (c_a) / Concrete Thickness (h) - in. (mm)	in.	(mm)	(44)	(44)	(44)	(44)	(44)	(44)
	1-1/4	(32)	0.64	n/a	0.56	n/a	n/a	n/a
	1-3/8	(35)	0.65	0.58	0.57	0.26	0.51	n/a
	1-1/2	(38)	0.67	0.61	0.57	0.29	0.58	n/a
	2	(51)	0.72	0.75	0.60	0.45	0.75	n/a
	3	(76)	0.83	1.00	0.65	0.83	1.00	n/a
	3-1/2	(89)	0.89		0.67	1.00		n/a
	4	(102)	0.94		0.70			0.88
	4-1/2	(114)	1.00		0.72			0.94
	5	(127)			0.74			0.99
	5-1/2	(140)			0.77			1.00
	6	(152)			0.79			
	7	(178)			0.84			
	8	(203)			0.89			
	9	(229)			0.94			
	10	(254)			0.99			
	11	(279)			1.00			

[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 Appendix D.

[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, this indicates that this specific edge distance may not be permitted with a certain spacing (or vice versa). Check with table 5 and figure 2 of this section to calculate permissable edge distance, spacing and concrete thickness combinations. Use of Hilti KWIK Bolt 3 anchors with edge distance and spacing dimensions smaller than what is noted in this table is permitted.

3.3.8 KWIK Bolt 3 Expansion Anchor

Table 7 - Load adjustment factors for 3/8-in. diameter KWIK Bolt 3 carbon steel anchor in uncracked concrete[1,2]

3/8-in. KB3 carbon steel 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		Concrete thickness factor in shear[4] f_{HV}
						⊥ Toward edge f_{RV}	II To edge f_{RV}	
Embedment h_{nom}			2-3/8	2-3/8	2-3/8	2-3/8	2-3/8	2-3/8
Spacing (s) / edge distance (c_a) / concrete thickness (h) - in. (mm)	in.	(mm)	(60)	(60)	(60)	(60)	(60)	(60)
	1-3/4	(44)	0.65	n/a	0.57	n/a	n/a	n/a
	2	(51)	0.67	0.50	0.58	0.35	0.50	n/a
	2-1/2	(64)	0.71	0.58	0.60	0.49	0.58	n/a
	3	(76)	0.75	0.67	0.62	0.64	0.67	n/a
	3-1/4	(83)	0.77	0.72	0.63	0.72	0.72	n/a
	3-1/2	(89)	0.79	0.78	0.64	0.81	0.81	n/a
	4	(102)	0.83	0.89	0.67	0.99	0.99	0.81
	4-1/2	(114)	0.88	1.00	0.69	1.00	1.00	0.86
	5	(127)	0.92		0.71			0.91
	6	(152)	1.00		0.75			1.00
	7	(178)			0.79			
	8	(203)			0.83			
	9	(229)			0.87			
	10	(254)			0.91			
	11	(279)			0.95			
	12	(305)			1.00			

Table 8 - Load adjustment factors for 1/2-in. diameter KWIK Bolt 3 carbon steel anchor in uncracked concrete[1,2]

1/2-in. KB3 carbon steel 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				Concrete thickness factor in shear[4] f_{HV}	
									⊥ Toward edge f_{RV}		II To edge f_{RV}			
Embedment h_{nom}			2-1/4	3-1/2	2-1/4	3-1/2	2-1/4	3-1/2	2-1/4	3-1/2	2-1/4	3-1/2	2-1/4	3-1/2
Spacing (s) / edge distance (c_a) / concrete thickness (h) - in. (mm)	in.	(mm)	(57)	(89)	(57)	(89)	(57)	(89)	(57)	(89)	(57)	(89)	(57)	(89)
	1-5/8	(41)	n/a	n/a	n/a	0.39	n/a	n/a	n/a	0.07	n/a	0.15	n/a	n/a
	2	(51)	n/a	0.60	n/a	0.42	n/a	0.54	n/a	0.10	n/a	0.20	n/a	n/a
	2-1/8	(54)	n/a	0.61	0.48	0.43	n/a	0.54	0.42	0.11	0.48	0.22	n/a	n/a
	2-1/2	(64)	0.71	0.63	0.54	0.47	0.61	0.55	0.53	0.14	0.54	0.28	n/a	n/a
	3	(76)	0.75	0.65	0.62	0.52	0.63	0.55	0.70	0.19	0.70	0.37	n/a	n/a
	3-1/2	(89)	0.79	0.68	0.72	0.57	0.65	0.56	0.88	0.23	0.88	0.47	n/a	n/a
	4	(102)	0.83	0.71	0.82	0.62	0.68	0.57	1.00	0.29	1.00	0.57	0.84	n/a
	4-1/2	(114)	0.88	0.73	0.92	0.68	0.70	0.58		0.34		0.68	0.89	n/a
	5	(127)	0.92	0.76	1.00	0.74	0.72	0.59		0.40		0.74	0.94	n/a
	6	(152)	1.00	0.81		0.89	0.76	0.61		0.53		0.89	1.00	0.66
	7	(178)		0.86		1.00	0.81	0.63		0.66		1.00		0.71
	8	(203)		0.91			0.85	0.64		0.81				0.76
	9	(229)		0.96			0.89	0.66		0.97				0.81
	10	(254)		1.00			0.94	0.68		1.00				0.85
	11	(279)					0.98	0.70						0.89
	12	(305)					1.00	0.72						0.93
	14	(356)						0.75						1.00
	16	(406)						0.79						
	18	(457)						0.83						
	20	(508)						0.86						
	> 24	(610)						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 Appendix D.

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, this indicates that this specific edge distance may not be permitted with a certain spacing (or vice versa). Check with table 5 and figure 2 of this section to calculate permissable edge distance, spacing and concrete thickness combinations. Use of Hilti KWIK Bolt 3 anchors with edge distance and spacing dimensions smaller than what is noted in this table is permitted.

Table 9 - Load adjustment factors for 5/8-in. diameter KWIK Bolt 3 carbon steel anchor in uncracked concrete[1,2]

5/8-in. KB3 carbon steel 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				Conc. thickness factor in shear[4] f_{HV}	
									⊥ toward edge f_{RV}		II to edge f_{RV}			
Embedment h_{nom}			3-1/2	4-3/8	3-1/2	4-3/8	3-1/2	4-3/8	3-1/2	4-3/8	3-1/2	4-3/8	3-1/2	4-3/8
	in.	(mm)	(89)	(111)	(89)	(111)	(89)	(111)	(89)	(111)	(89)	(111)	(89)	(111)
Spacing (s) / edge distance (c_a) / concrete thickness (h) - in. (mm)	1-3/4	(44)	n/a	n/a	n/a	0.32	n/a	n/a	n/a	0.07	n/a	0.14	n/a	n/a
	2	(51)	n/a	n/a	n/a	0.34	n/a	n/a	n/a	0.08	n/a	0.17	n/a	n/a
	2-1/8	(54)	n/a	0.59	n/a	0.34	n/a	0.53	n/a	0.09	n/a	0.18	n/a	n/a
	2-1/4	(57)	n/a	0.59	0.39	0.35	n/a	0.54	0.14	0.10	0.27	0.20	n/a	n/a
	2-3/8	(60)	0.63	0.60	0.40	0.36	0.55	0.54	0.15	0.11	0.30	0.21	n/a	n/a
	2-1/2	(64)	0.63	0.60	0.41	0.37	0.55	0.54	0.16	0.12	0.32	0.23	n/a	n/a
	3	(76)	0.66	0.63	0.46	0.40	0.56	0.55	0.21	0.15	0.42	0.30	n/a	n/a
	4	(102)	0.71	0.67	0.55	0.47	0.58	0.56	0.32	0.23	0.55	0.47	n/a	n/a
	5	(127)	0.77	0.71	0.67	0.55	0.60	0.58	0.45	0.33	0.67	0.55	0.63	n/a
	6	(152)	0.82	0.75	0.80	0.63	0.62	0.59	0.59	0.43	0.80	0.63	0.69	0.62
	7	(178)	0.87	0.79	0.93	0.74	0.64	0.61	0.75	0.54	0.93	0.74	0.74	0.67
	8	(203)	0.93	0.83	1.00	0.84	0.66	0.63	0.91	0.66	1.00	0.84	0.79	0.71
	9	(229)	0.98	0.88		0.95	0.68	0.64	1.00	0.79		0.95	0.84	0.75
	10	(254)	1.00	0.92		1.00	0.70	0.66		0.92		1.00	0.89	0.80
	11	(279)		0.96			0.72	0.67		1.00			0.93	0.83
	12	(305)		1.00			0.74	0.69					0.97	0.87
	14	(356)					0.77	0.72					1.00	0.94
	16	(406)					0.81	0.75						1.00
	18	(457)					0.85	0.78						
	20	(508)					0.89	0.82						
	24	(610)					0.97	0.88						
	> 30	(762)					1.00	0.97						

Table 10 - Load adjustment factors for 3/4-in. diameter KWIK Bolt 3 carbon steel anchor in uncracked concrete[1,2]

3/4-in. KB3 carbon steel 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				Conc. thickness factor in shear[4] f_{HV}	
									⊥ toward edge f_{RV}		II to edge f_{RV}			
Embedment h_{nom}			4-1/4	5-1/2	4-1/4	5-1/2	4-1/4	5-1/2	4-1/4	5-1/2	4-1/4	5-1/2	4-1/4	5-1/2
	in.	(mm)	(108)	(140)	(108)	(140)	(108)	(140)	(108)	(140)	(108)	(140)	(108)	(140)
Spacing (s) / edge distance (c_a) / concrete thickness (h) - in. (mm)	2-1/2	(64)	n/a	n/a	n/a	0.42	n/a	n/a	n/a	0.09	n/a	0.18	n/a	n/a
	2-3/4	(70)	n/a	n/a	0.36	0.44	n/a	n/a	0.15	0.11	0.31	0.21	n/a	n/a
	3	(76)	n/a	n/a	0.38	0.45	n/a	n/a	0.17	0.12	0.35	0.24	n/a	n/a
	3-1/4	(83)	n/a	0.61	0.40	0.47	n/a	0.54	0.20	0.14	0.39	0.27	n/a	n/a
	3-1/2	(89)	n/a	0.62	0.41	0.49	n/a	0.55	0.22	0.15	0.41	0.30	n/a	n/a
	3-3/4	(95)	0.67	0.63	0.43	0.50	0.57	0.55	0.24	0.17	0.43	0.34	n/a	n/a
	4	(102)	0.68	0.63	0.45	0.52	0.57	0.55	0.27	0.18	0.45	0.37	n/a	n/a
	4-1/2	(114)	0.70	0.65	0.49	0.56	0.58	0.56	0.32	0.22	0.49	0.44	n/a	n/a
	5	(127)	0.72	0.67	0.53	0.59	0.59	0.57	0.38	0.26	0.53	0.52	n/a	n/a
	6	(152)	0.77	0.70	0.62	0.67	0.60	0.58	0.49	0.34	0.62	0.67	0.65	n/a
	7	(178)	0.81	0.73	0.72	0.75	0.62	0.59	0.62	0.43	0.72	0.75	0.70	n/a
	8	(203)	0.86	0.77	0.82	0.84	0.64	0.61	0.76	0.52	0.82	0.84	0.75	0.66
	9	(229)	0.90	0.80	0.92	0.95	0.66	0.62	0.91	0.62	0.92	0.95	0.79	0.70
	10	(254)	0.94	0.83	1.00	1.00	0.67	0.64	1.00	0.73	1.00	1.00	0.83	0.74
	11	(279)	0.99	0.87			0.69	0.65		0.84			0.87	0.77
	12	(305)	1.00	0.90			0.71	0.66		0.96			0.91	0.81
	14	(356)		0.97			0.74	0.69		1.00			0.99	0.87
	16	(406)		1.00			0.78	0.72					1.00	0.93
	18	(457)					0.81	0.74						0.99
	20	(508)					0.85	0.77						1.00
	24	(610)					0.92	0.82						
	30	(762)					1.00	0.91						
	> 36	(914)						0.99						

[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 Appendix D.

[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, this indicates that this specific edge distance may not be permitted with a certain spacing (or vice versa). Check with table 5 and figure 2 of this section to calculate permissable edge distance, spacing and concrete thickness combinations. Use of Hilti KWIK Bolt 3 anchors with edge distance and spacing dimensions smaller than what is noted in this table is permitted.

3.3.8 KWIK Bolt 3 Expansion Anchor

Table 11 - Hilti KWIK Bolt 3 stainless steel design strength with concrete / pullout failure in uncracked concrete[1,2,3,4]

Nominal anchor diameter	Effective embed. in. (mm)	Nominal embed. in. (mm)	Tension - ϕN_n				Shear - ϕV_n			
			f'_c = 2500 psi lb (kN)	f'_c = 3000 psi lb (kN)	f'_c = 4000 psi lb (kN)	f'_c = 6000 psi lb (kN)	f'_c = 2500 psi lb (kN)	f'_c = 3000 psi lb (kN)	f'_c = 4000 psi lb (kN)	f'_c = 6000 psi lb (kN)
1/4	1-1/2 (38)	1-3/4 (44)	730 (3.2)	770 (3.4)	840 (3.7)	950 (4.2)	1,545 (6.9)	1,690 (7.5)	1,950 (8.7)	2,390 (10.6)
3/8	2 (51)	2-3/8 (60)	1,925 (8.6)	2,110 (9.4)	2,440 (10.9)	2,985 (13.3)	2,375 (10.6)	2,605 (11.6)	3,005 (13.4)	3,680 (16.4)
1/2	2 (51)	2-1/4 (57)	2,150 (9.6)	2,355 (10.5)	2,720 (12.1)	3,335 (14.8)	2,375 (10.6)	2,605 (11.6)	3,005 (13.4)	3,680 (16.4)
	3-1/4 (83)	3-1/2 (89)	3,920 (17.4)	4,295 (19.1)	4,960 (22.1)	6,070 (27.0)	9,845 (43.8)	10,785 (48.0)	12,450 (55.4)	15,250 (67.8)
5/8	3-1/8 (79)	3-1/2 (89)	4,050 (18.0)	4,435 (19.7)	5,120 (22.8)	6,275 (27.9)	9,280 (41.3)	10,165 (45.2)	11,740 (52.2)	14,380 (64.0)
	4 (102)	4-3/8 (111)	5,090 (22.6)	5,575 (24.8)	6,440 (28.6)	7,885 (35.1)	13,440 (59.8)	14,725 (65.5)	17,000 (75.6)	20,820 (92.6)
3/4	3-3/4 (95)	4-1/4 (108)	5,560 (24.7)	6,090 (27.1)	7,035 (31.3)	8,615 (38.3)	12,200 (54.3)	13,365 (59.5)	15,430 (68.6)	18,900 (84.1)
	5 (127)	5-1/2 (140)	7,040 (31.3)	7,710 (34.3)	8,905 (39.6)	10,905 (48.5)	18,785 (83.6)	20,575 (91.5)	23,760 (105.7)	29,100 (129.4)
1	4 (102)	4-1/2 (114)	6,240 (27.8)	6,835 (30.4)	7,895 (35.1)	9,665 (43.0)	13,440 (59.8)	14,725 (65.5)	17,000 (75.6)	20,820 (92.6)
	5-3/4 (146)	6-1/4 (159)	10,110 (45.0)	11,070 (49.2)	12,785 (56.9)	15,660 (69.7)	23,165 (103.0)	25,375 (112.9)	29,300 (130.3)	35,885 (159.6)

1 See section 3.1.7.3 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 14 to 19 as necessary. Compare to steel values in table 12. 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

Table 12 - Steel design strength for Hilti KWIK Bolt 3 stainless steel anchors[1,2]

Nominal anchor diameter	Nominal embedment in. (mm)	Tensile[3] ϕN_{sa} lb (kN)	Shear[4] ϕV_{sa} lb (kN)
1/4	1-3/4 (44)	1,725 (7.7)	1,090 (4.8)
3/8	2-3/8 (60)	5,175 (23.0)	3,235 (14.4)
1/2	2-1/4 (57)	9,490 (42.2)	2,725 (12.1)
	3-1/2 (89)		4,510 (20.1)
5/8	3-1/2 (89)	14,665 (65.2)	5,820 (25.9)
	4-3/8 (111)		9,295 (41.3)
3/4	4-1/4 (108)	16,200 (72.1)	7,735 (34.4)
	5-1/2 (140)		15,305 (68.1)
1	4-1/2 (114)	31,735 (141.2)	8,130 (36.2)
	6-1/4 (159)		17,775 (79.1)

[1] See section 3.1.7.3 to convert design strength value to ASD value.

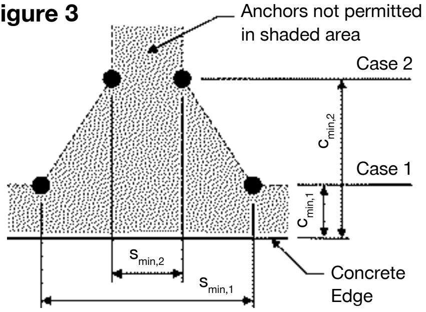
[2] KWIK Bolt 3 stainless steel anchors are to be considered ductile steel elements.

[3] Tensile $\phi N_{sa} = \phi A_{se,N} f_{uta}$ as noted in ACI 318 Appendix D.

[4] Shear values determined by static shear tests with $\phi V_{sa} < \phi\ 0.60\ A_{se,V}\ f_{uta}$ as noted in ACI 318 Appendix D.

3.3.8 KWIK Bolt 3 Expansion Anchor

Figure 3



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

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

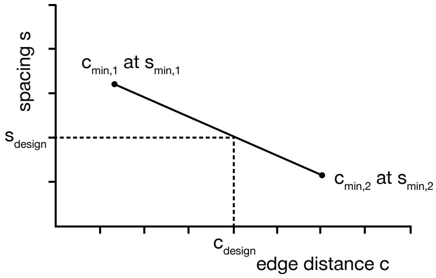


Table 13 - Stainless steel KWIK Bolt 3 installation parameters[1]

Setting information	Symbol	Units	Nominal anchor diameter d_o															
			1/4	3/8		1/2				5/8			3/4			1	
Effective minimum embedment	h_{ef}	in.	1-1/2	2		2		3-1/4		3-1/8	4		3-3/4		5	4	5-3/4
		(mm)	(38)	(51)		(51)		(83)		(79)	(102)		(95)		(127)	(102)	(146)
Minimum member thickness	h_{min}	in.	4	4	5	4	6	6	8	5	6	8	6	8	8	8	10
		(mm)	(102)	(102)	(127)	(102)	(152)	(152)	(203)	(127)	(152)	(203)	(152)	(203)	(203)	(203)	(254)
Case 1	$c_{min,1}$	in.	1-3/8	2	1-5/8	2-1/2	1-7/8	1-5/8	1-5/8	3-1/4	2-1/2	2-1/2	3-1/4	3	2-7/8	3/1/02	3
		(mm)	(35)	(51)	(41)	(68)	(48)	(41)	(41)	(83)	(64)	(64)	(83)	(76)	(73)	(89)	(76)
	for $s_{min,1}$ ≥	in.	1-3/4	4	3-5/8	5	4-5/8	4-1/2	4-1/4	5-5/8	5-1/4	5	7	6-7/8	6-5/8	6-3/4	6-3/4
		(mm)	(44)	(102)	(92)	(127)	(117)	(114)	(108)	(143)	(133)	(127)	(178)	(175)	(168)	(172)	(172)
Case 2	$c_{min,2}$	in.	1-5/8	1-3/4	2-1/2	2-7/8	2-3/8	2-3/8	2-1/8	3-7/8	3	2-3/4	4-1/8	3-3/4	3-3/4	4-1/4	3-3/4
		(mm)	(41)	(83)	(64)	(73)	(60)	(60)	(54)	(98)	(76)	(70)	(105)	(95)	(95)	(108)	(95)
	for $s_{min,2}$ ≥	in.	1-1/4	2	1-3/4	2-1/2	2-1/4	2-1/8	1-7/8	3-1/8	2-1/8	4	3-1/2	3-1/2	3-1/2	5	4-3/4
		(mm)	(32)	(51)	(44)	(64)	(57)	(54)	(48)	(79)	(54)	(54)	(102)	(89)	(89)	(127)	(121)

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 spacings.

Table 14 - Load adjustment factors for 1/4-in. diameter KWIK Bolt 3 stainless steel anchor in uncracked concrete[1,2]

1/4-in. KB3 stainless steel uncracked uoncrete			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 edge f_{RV}	Concrete thickness factor in shear[4] f_{HV}
Embedment h_{nom}			1-3/4	1-3/4	1-3/4	1-3/4	1-3/4	1-3/4
Spacing (s) / edge distance (c_a) / concrete thickness (h) - in. (mm)	in.	(mm)	(44)	(44)	(44)	(44)	(44)	(44)
	1-1/4	(32)	0.64	n/a	0.56	n/a	n/a	n/a
	1-3/8	(35)	0.65	0.53	0.57	0.26	0.51	n/a
	1-1/2	(38)	0.67	0.56	0.57	0.29	0.56	n/a
	2	(51)	0.72	0.68	0.60	0.45	0.68	n/a
	3	(76)	0.83	1.00	0.65	0.83	1.00	n/a
	3-1/2	(89)	0.89		0.67	1.00		n/a
	4	(102)	0.94		0.70			0.88
	4-1/2	(114)	1.00		0.72			0.94
	5	(127)			0.74			0.99
	5-1/2	(140)			0.77			1.00
	6	(152)			0.79			
	7	(178)			0.84			
	8	(203)			0.89			
	9	(229)			0.94			
	10	(254)			0.99			
	11	(279)			1.00			

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 Appendix D.

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, this indicates that this specific edge distance may not be permitted with a certain spacing (or vice versa). Check with table 13 and figure 3 of this section to calculate permissable edge distance, spacing and concrete thickness combinations. Use of Hilti KWIK Bolt 3 anchors with edge distance and spacing dimensions smaller than what is noted in this table is permitted.

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Table 15 - Load adjustment factors for 3/8-in. diameter KWIK Bolt 3 stainless steel anchor in uncracked concrete[1,2]

3/8-in. KB3 stainless steel 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		Concrete thickness factor in shear[4] f_{HV}
						⊥ toward edge f_{RV}	II to edge f_{RV}	
Embedment h_{nom}			2-3/8	2-3/8	2-3/8	2-3/8	2-3/8	2-3/8
Spacing (s) / edge distance (c_a) / concrete thickness (h) - in. (mm)	in.	(mm)	(60)	(60)	(60)	(60)	(60)	(60)
	2	(51)	0.67	0.51	0.58	0.35	0.51	n/a
	2-1/2	(64)	0.71	0.60	0.60	0.49	0.60	n/a
	3	(76)	0.75	0.69	0.62	0.64	0.69	n/a
	3-1/2	(89)	0.79	0.80	0.64	0.81	0.81	n/a
	4	(102)	0.83	0.91	0.67	0.99	0.99	0.81
	4-1/2	(114)	0.88	1.00	0.69	1.00	1.00	0.86
	5	(127)	0.92		0.71			0.91
	6	(152)	1.00		0.75			1.00
	7	(178)			0.79			
	8	(203)			0.83			
	9	(229)			0.87			
	10	(254)			0.91			
	11	(279)			0.95			
	12	(305)			1.00			
	14	(356)						

Table 16 - Load adjustment factors for 1/2-in. diameter KWIK Bolt 3 stainless steel anchor in uncracked concrete[1,2]

1/2-in. KB3 stainless steel 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				Concrete thickness factor in shear[4] f_{HV}	
									⊥ toward edge f_{RV}		II to edge f_{RV}			
Embedment h_{nom}			2-1/4	3-1/2	2-1/4	3-1/2	2-1/4	3-1/2	2-1/4	3-1/2	2-1/4	3-1/2	2-1/4	3-1/2
Spacing (s) / edge distance (c_a) / concrete thickness (h) - in. (mm)	in.	(mm)	(57)	(89)	(57)	(89)	(57)	(89)	(57)	(89)	(57)	(89)	(57)	(89)
	1-5/8	(41)	n/a	n/a	n/a	0.39	n/a	n/a	n/a	0.07	n/a	0.15	n/a	n/a
	2	(51)	n/a	n/a	n/a	0.42	n/a	n/a	n/a	0.10	n/a	0.20	n/a	n/a
	2-1/8	(54)	n/a	0.61	n/a	0.43	n/a	0.54	n/a	0.11	n/a	0.22	n/a	n/a
	2-1/2	(64)	0.71	0.63	0.54	0.47	0.61	0.55	0.53	0.14	0.54	0.28	n/a	n/a
	3	(76)	0.75	0.65	0.62	0.52	0.63	0.55	0.70	0.19	0.70	0.37	n/a	n/a
	3-1/2	(89)	0.79	0.68	0.72	0.57	0.65	0.56	0.88	0.23	0.88	0.47	n/a	n/a
	4	(102)	0.83	0.71	0.82	0.62	0.68	0.57	1.00	0.29	1.00	0.57	0.84	n/a
	4-1/2	(114)	0.88	0.73	0.92	0.68	0.70	0.58		0.34		0.68	0.89	n/a
	5	(127)	0.92	0.76	1.00	0.74	0.72	0.59		0.40		0.74	0.94	n/a
	6	(152)	1.00	0.81		0.89	0.76	0.61		0.53		0.89	1.00	0.66
	7	(178)		0.86		1.00	0.81	0.63		0.66		1.00		0.71
	8	(203)		0.91			0.85	0.64		0.81				0.76
	9	(229)		0.96			0.89	0.66		0.97				0.81
	10	(254)		1.00			0.94	0.68		1.00				0.85
	11	(279)					0.98	0.70						0.89
	12	(305)					1.00	0.72						0.93
	14	(356)						0.75						1.00
	16	(406)						0.79						
	18	(457)						0.83						
	20	(508)						0.86						
	> 24	(610)						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 Appendix D.

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, this indicates that this specific edge distance may not be permitted with a certain spacing (or vice versa). Check with table 13 and figure 3 of this section to calculate permissable edge distance, spacing and concrete thickness combinations. Use of Hilti KWIK Bolt 3 anchors with edge distance and spacing dimensions smaller than what is noted in this table is permitted.

3.3.8 KWIK Bolt 3 Expansion Anchor

Table 17 - Load adjustment factors for 5/8-in. diameter KWIK Bolt 3 stainless steel anchor in uncracked concrete[1,2]

5/8-in. KB3 stainless steel 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				Concrete thickness factor in shear[4] f_{HV}	
									⊥ toward edge f_{RV}		II to edge f_{RV}			
Embedment h_{nom}			3-1/2	4-3/8	3-1/2	4-3/8	3-1/2	4-3/8	3-1/2	4-3/8	3-1/2	4-3/8	3-1/2	4-3/8
Spacing (s) / edge distance (c_a) / concrete thickness (h) - in. (mm)	in.	(mm)	(89)	(111)	(89)	(111)	(89)	(111)	(89)	(111)	(89)	(111)	(89)	(111)
	2-1/8	(54)	n/a	0.59	n/a	n/a	n/a	0.53	n/a	n/a	n/a	n/a	n/a	n/a
	2-1/2	(64)	n/a	0.60	n/a	0.37	n/a	0.54	n/a	0.12	n/a	0.23	n/a	n/a
	3	(76)	n/a	0.63	n/a	0.40	n/a	0.55	n/a	0.15	n/a	0.30	n/a	n/a
	3-1/8	(79)	0.67	0.63	n/a	0.41	0.56	0.55	n/a	0.16	n/a	0.32	n/a	n/a
	3-1/4	(83)	0.67	0.64	0.49	0.42	0.56	0.55	0.24	0.17	0.47	0.34	n/a	n/a
	3-1/2	(89)	0.69	0.65	0.51	0.44	0.57	0.56	0.26	0.19	0.51	0.38	n/a	n/a
	4	(102)	0.71	0.67	0.56	0.47	0.58	0.56	0.32	0.23	0.56	0.47	n/a	n/a
	5	(127)	0.77	0.71	0.68	0.55	0.60	0.58	0.45	0.33	0.68	0.55	0.63	n/a
	6	(152)	0.82	0.75	0.81	0.63	0.62	0.59	0.59	0.43	0.81	0.63	0.69	0.62
	7	(178)	0.87	0.79	0.95	0.74	0.64	0.61	0.75	0.54	0.95	0.74	0.74	0.67
	8	(203)	0.93	0.83	1.00	0.84	0.66	0.63	0.91	0.66	1.00	0.84	0.79	0.71
	9	(229)	0.98	0.88		0.95	0.68	0.64	1.00	0.79		0.95	0.84	0.75
	10	(254)	1.00	0.92		1.00	0.70	0.66		0.92		1.00	0.89	0.80
	11	(279)		0.96			0.72	0.67		1.00			0.93	0.83
	12	(305)		1.00			0.74	0.69					0.97	0.87
	14	(356)					0.77	0.72					1.00	0.94
	16	(406)					0.81	0.75						1.00
	18	(457)					0.85	0.78						
	20	(508)					0.89	0.82						
	24	(610)					0.97	0.88						
	> 30	(762)					1.00	0.97						

Table 18 - Load adjustment factors for 3/4-in. diameter KWIK Bolt 3 stainless steel anchor in uncracked concrete[1,2]

3/4-in. KB3 stainless steel 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				Concrete thickness factor in shear[4] f_{HV}	
									⊥ toward edge f_{RV}		II to edge f_{RV}			
Embedment h_{nom}			4-1/4	5-1/2	4-1/4	5-1/2	4-1/4	5-1/2	4-1/4	5-1/2	4-1/4	5-1/2	4-1/4	5-1/2
Spacing (s) / edge distance (c_a) / concrete thickness (h) - in. (mm)	in.	(mm)	(108)	(140)	(108)	(140)	(108)	(140)	(108)	(140)	(108)	(140)	(108)	(140)
	2-7/8	(73)	n/a	n/a	n/a	0.43	n/a	n/a	n/a	0.11	n/a	0.23	n/a	n/a
	3	(76)	n/a	n/a	n/a	0.44	n/a	n/a	n/a	0.12	n/a	0.24	n/a	n/a
	3-1/4	(83)	n/a	n/a	0.37	0.46	n/a	n/a	0.20	0.14	0.37	0.27	n/a	n/a
	3-1/2	(89)	n/a	0.62	0.39	0.47	n/a	0.55	0.22	0.15	0.39	0.30	n/a	n/a
	4	(102)	0.68	0.63	0.42	0.51	0.57	0.55	0.27	0.18	0.42	0.37	n/a	n/a
	4-1/2	(114)	0.70	0.65	0.45	0.54	0.58	0.56	0.32	0.22	0.45	0.44	n/a	n/a
	5	(127)	0.72	0.67	0.49	0.58	0.59	0.57	0.38	0.26	0.49	0.52	n/a	n/a
	6	(152)	0.77	0.70	0.57	0.65	0.60	0.58	0.49	0.34	0.57	0.65	0.65	n/a
	7	(178)	0.81	0.73	0.67	0.73	0.62	0.59	0.62	0.43	0.67	0.73	0.70	n/a
	8	(203)	0.86	0.77	0.76	0.82	0.64	0.61	0.76	0.52	0.76	0.82	0.75	0.66
	9	(229)	0.90	0.80	0.86	0.92	0.66	0.62	0.91	0.62	0.91	0.92	0.79	0.70
	10	(254)	0.94	0.83	0.95	1.00	0.67	0.64	1.00	0.73	1.00	1.00	0.83	0.74
	11	(279)	0.99	0.87	1.00		0.69	0.65		0.84			0.87	0.77
	12	(305)	1.00	0.90			0.71	0.66		0.96			0.91	0.81
	14	(356)		0.97			0.74	0.69		1.00			0.99	0.87
	16	(406)		1.00			0.78	0.72					1.00	0.93
	18	(457)					0.81	0.74						0.99
	20	(508)					0.85	0.77						1.00
	24	(610)					0.92	0.82						
	30	(762)					1.00	0.91						
	> 36	(914)						0.99						

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 Appendix D.

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, this indicates that this specific edge distance may not be permitted with a certain spacing (or vice versa). Check with table 13 and figure 3 of this section to calculate permissable edge distance, spacing and concrete thickness combinations. Use of Hilti KWIK Bolt 3 anchors with edge distance and spacing dimensions smaller than what is noted in this table is permitted.

KWIK Bolt 3 Expansion Anchor 3.3.8

Table 19 - Load adjustment factors for 1-in. diameter KWIK Bolt 3 stainless steel anchor in uncracked concrete[1,2]

1-in. KB3 stainless steel 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 edge f_{RV}		Concrete thickness factor in shear[4] f_{HV}	
Embedment h_{nom}			4-1/2	6-1/4	4-1/2	6-1/4	4-1/2	6-1/4	4-1/2	6-1/4	4-1/2	6-1/4	4-1/2	6-1/4
Spacing (s) / edge distance (c_a) / concrete thickness (h) - in. (mm)	in.	(mm)	(114)	(159)	(114)	(159)	(114)	(159)	(114)	(159)	(114)	(159)	(114)	(159)
	3	(76)	n/a	n/a	n/a	0.43	n/a	n/a	n/a	0.10	n/a	0.20	n/a	n/a
	3-1/2	(89)	n/a	n/a	0.42	0.45	n/a	n/a	0.21	0.12	0.42	0.25	n/a	n/a
	4	(102)	n/a	n/a	0.45	0.48	n/a	n/a	0.26	0.15	0.45	0.30	n/a	n/a
	4-1/2	(114)	n/a	n/a	0.49	0.51	n/a	n/a	0.31	0.18	0.49	0.36	n/a	n/a
	4-3/4	(121)	n/a	0.64	0.50	0.53	n/a	0.56	0.34	0.20	0.50	0.39	n/a	n/a
	5	(127)	0.71	0.64	0.52	0.54	0.59	0.56	0.37	0.21	0.52	0.43	n/a	n/a
	6	(152)	0.75	0.67	0.60	0.60	0.60	0.57	0.48	0.28	0.60	0.56	n/a	n/a
	7	(178)	0.79	0.70	0.70	0.67	0.62	0.58	0.61	0.35	0.70	0.67	n/a	n/a
	8	(203)	0.83	0.73	0.80	0.74	0.64	0.60	0.74	0.43	0.80	0.74	0.74	n/a
	9	(229)	0.88	0.76	0.90	0.82	0.65	0.61	0.89	0.51	0.90	0.82	0.78	n/a
	10	(254)	0.92	0.79	1.00	0.91	0.67	0.62	1.00	0.60	1.00	0.91	0.83	0.69
	11	(279)	0.96	0.82		1.00	0.69	0.63		0.69		1.00	0.87	0.72
	12	(305)	1.00	0.85			0.70	0.64		0.79			0.91	0.76
	14	(356)		0.91			0.74	0.67		1.00			0.98	0.82
	16	(406)		0.96			0.77	0.69					1.00	0.87
	18	(457)		1.00			0.81	0.71						0.92
	20	(508)					0.84	0.74						0.98
	24	(610)					0.91	0.79						1.00
	30	(762)					1.00	0.86						
	> 36	(914)						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 Appendix D.

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, this indicates that this specific edge distance may not be permitted with a certain spacing (or vice versa). Check with table 13 and figure 3 of this section to calculate permissable edge distance, spacing and concrete thickness combinations. Use of Hilti KWIK Bolt 3 anchors with edge distance and spacing dimensions smaller than what is noted in this table is permitted.

3.3.8 KWIK Bolt 3 Expansion Anchor

Table 20 - Hilti KWIK Bolt 3 hot-dip galvanized design strength with concrete / pullout failure in uncracked concrete[1,2,3,4]

Nominal anchor diameter	Effective embed. in. (mm)	Nominal embed. in. (mm)	Tension - ϕN_n				Shear - ϕV_n			
			f'_c = 2500 psi lb (kN)	f'_c = 3000 psi lb (kN)	f'_c = 4000 psi lb (kN)	f'_c = 6000 psi lb (kN)	f'_c = 2500 psi lb (kN)	f'_c = 3000 psi lb (kN)	f'_c = 4000 psi lb (kN)	f'_c = 6000 psi lb (kN)
1/2	2 (51)	2-1/4 (57)	2,205 (9.8)	2,415 (10.7)	2,790 (12.4)	3,420 (15.2)	2,375 (10.6)	2,605 (11.6)	3,005 (13.4)	3,680 (16.4)
	3-1/4 (83)	3-1/2 (89)	4,250 (18.9)	4,655 (20.7)	5,375 (23.9)	6,585 (29.3)	9,845 (43.8)	10,785 (48.0)	12,450 (55.4)	15,250 (67.8)
5/8	3-1/8 (79)	3-1/2 (89)	4,200 (18.7)	4,605 (20.5)	5,315 (23.6)	6,510 (29.0)	9,280 (41.3)	10,165 (45.2)	11,740 (52.2)	14,380 (64.0)
	4 (102)	4-3/8 (111)	5,860 (26.1)	6,420 (28.6)	7,415 (33.0)	9,080 (40.4)	13,440 (59.8)	14,725 (65.5)	17,000 (75.6)	20,820 (92.6)
3/4	3-3/4 (95)	4-1/4 (108)	5,665 (25.2)	6,205 (27.6)	7,165 (31.9)	8,775 (39.0)	12,200 (54.3)	13,365 (59.5)	15,430 (68.6)	18,900 (84.1)
	5 (127)	5-1/2 (140)	6,615 (29.4)	7,245 (32.2)	8,365 (37.2)	10,245 (45.6)	18,785 (83.6)	20,575 (91.5)	23,760 (105.7)	29,100 (129.4)

[1] See section 3.1.7.3 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 23 to 25 as necessary. Compare to steel values in table 21. 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

Table 21 - Steel design strength for Hilti KWIK Bolt 3 hot-dip galvanized anchors[1,2]

Nominal anchor diameter	Nominal embedment in. (mm)	Tensile[3] ϕN_{sa} lb (kN)	Shear[4] ϕV_{sa} lb (kN)
1/2	2-1/4 (57)	8,745 (38.9)	2,925 (13.0)
	3-1/2 (89)		3,815 (17.0)
5/8	3-1/2 (89)	13,515 (60.1)	7,565 (33.7)
	4-3/8 (111)		
3/4	4-1/4 (108)	19,080 (84.9)	11,050 (49.2)
	5-1/2 (140)		

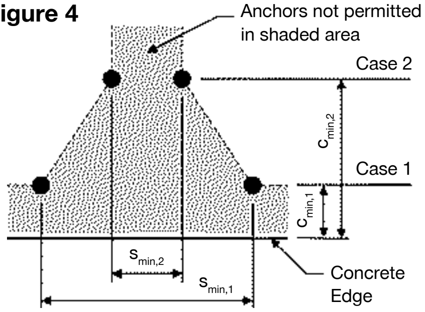
[1] See section 3.1.7.3 to convert design strength value to ASD value.

[2] KWIK Bolt 3 carbon steel anchors are to be considered ductile steel elements.

[3] Tensile $\phi N_{sa} = \phi\ A_{se,N}\ f_{uta}$ as noted in ACI 318 Appendix D.

[4] Shear values determined by static shear tests with $\phi V_{sa} < \phi\ 0.60\ A_{se,V}\ f_{uta}$ as noted in ACI 318 Appendix D.

Figure 4



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

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

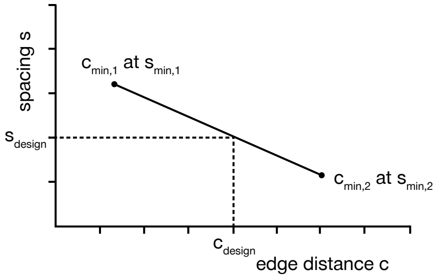


Table 22 - Hot-dip galvanized KWIK Bolt 3 installation parameters[1]

			Nominal anchor diameter d_o									
Setting information	Symbol	Units	1/2				5/8			3/4		
Effective minimum embedment	h_{ef}	in.	2		3-1/4		3-1/8	4		3-3/4		5
		(mm)	(51)		(83)		(79)	(102)		(95)		(127)
Minimum member thickness	h_{min}	in.	4	6	6	8	5	6	8	6	8	8
		(mm)	(102)	(152)	(152)	(203)	(127)	(152)	(203)	(152)	(203)	(203)
Case 1	$c_{min,1}$	in.	3-1/4	2-5/8	2		2-1/4	2	1-78	3-1/2		3-5/8
		(mm)	(83)	(67)	(51)		(57)	(51)	(48)	(89)		(92)
	for $s_{min,1} \geq$	in.	6-1/4	5-1/2	4-7/8		5-1/4	5	4-3/4	7-1/2		7-3/8
		(mm)	(158)	(140)	(124)		(133)	(127)	(121)	(191)		(187)
Case 2	$c_{min,2}$	in.	3-3/4	2-3/4	2-5/8	2-1/4	3-1/2	2-1/2	2-1/4	6-1/2		4-3/4
		(mm)	(95)	(70)	(67)	(57)	(89)	(64)	(57)	(165)		(121)
	for $s_{min,2} \geq$	in.	3-1/8	2-3/4	2-3/8	2-1/8	2-1/2	2-1/8	2-1/8	4		3-7/8
		(mm)	(79)	(70)	(60)	(54)	(64)	(54)	(54)	(102)		(98)

[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 spacings.

3.3.8 KWIK Bolt 3 Expansion Anchor

Table 23 - Load adjustment factors for 1/2-in. diameter KWIK Bolt 3 hot-dip galvanized anchor in uncracked concrete[1,2]

1/2-in. KB3 hot-dip galvanized 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 edge f_{RV}		Conc. thickness factor in shear[4] f_{HV}	
Embedment h_{nom}		2-1/4	3-1/2	2-1/4	3-1/2	2-1/4	3-1/2	2-1/4	3-1/2	2-1/4	3-1/2	2-1/4	3-1/2
Spacing (s) / edge distance (c_a) / concrete thickness (h) - in. (mm) in.	(mm)	(57)	(89)	(57)	(89)	(57)	(89)	(57)	(89)	(57)	(89)	(57)	(89)
2	(51)	n/a	n/a	n/a	0.38	n/a	n/a	n/a	0.10	n/a	0.20	n/a	n/a
2-3/8	(60)	n/a	0.62	n/a	0.41	n/a	0.54	n/a	0.13	n/a	0.26	n/a	n/a
2-1/2	(64)	n/a	0.63	n/a	0.42	n/a	0.55	n/a	0.14	n/a	0.28	n/a	n/a
3	(76)	n/a	0.65	n/a	0.46	n/a	0.55	n/a	0.19	n/a	0.37	n/a	n/a
3-1/8	(79)	0.76	0.66	n/a	0.48	0.64	0.56	n/a	0.20	n/a	0.40	n/a	n/a
3-1/4	(83)	0.77	0.67	0.67	0.49	0.64	0.56	0.79	0.21	0.79	0.42	n/a	n/a
3-1/2	(89)	0.79	0.68	0.72	0.51	0.65	0.56	0.88	0.23	0.88	0.47	n/a	n/a
4	(102)	0.83	0.71	0.82	0.56	0.68	0.57	1.00	0.29	1.00	0.56	0.84	n/a
4-1/2	(114)	0.88	0.73	0.92	0.61	0.70	0.58		0.34		0.61	0.89	n/a
5	(127)	0.92	0.76	1.00	0.67	0.72	0.59		0.40		0.67	0.94	n/a
6	(152)	1.00	0.81		0.80	0.76	0.61		0.53		0.80	1.00	0.66
7	(178)	1.00	0.86		0.93	0.81	0.63		0.66		0.93		0.71
8	(203)		0.91		1.00	0.85	0.64		0.81		1.00		0.76
9	(229)		0.96			0.89	0.66		0.97				0.81
10	(254)		1.00			0.94	0.68		1.00				0.85
11	(279)					0.98	0.70						0.89
12	(305)					1.00	0.72						0.93
14	(356)						0.75						1.00
16	(406)						0.79						
18	(457)						0.83						
20	(508)						0.86						
> 24	(610)						0.93						

Table 24 - Load adjustment factors for 5/8-in. diameter KWIK Bolt 3 hot-dip galvanized anchor in uncracked concrete[1,2]

5/8-in. KB3 hot-dip galvanized 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 edge f_{RV}		Conc. thickness factor in shear[4] f_{HV}	
Embedment h_{nom}		3-1/2	4-3/8	3-1/2	4-3/8	3-1/2	4-3/8	3-1/2	4-3/8	3-1/2	4-3/8	3-1/2	4-3/8
Spacing (s) / edge distance (c_a) / concrete thickness (h) - in. (mm) in.	(mm)	(89)	(111)	(89)	(111)	(89)	(111)	(89)	(111)	(89)	(111)	(89)	(111)
2	(51)	n/a	n/a	n/a	0.34	n/a	n/a	n/a	0.08	n/a	0.17	n/a	n/a
2-1/8	(54)	n/a	0.59	n/a	0.34	n/a	0.53	n/a	0.09	n/a	0.18	n/a	n/a
2-1/4	(57)	n/a	0.59	0.38	0.35	n/a	0.54	0.14	0.10	0.27	0.20	n/a	n/a
2-1/2	(64)	0.63	0.60	0.41	0.37	0.55	0.54	0.16	0.12	0.32	0.23	n/a	n/a
3	(76)	0.66	0.63	0.45	0.40	0.56	0.55	0.21	0.15	0.42	0.30	n/a	n/a
3-1/2	(89)	0.69	0.65	0.50	0.44	0.57	0.56	0.26	0.19	0.50	0.38	n/a	n/a
4	(102)	0.71	0.67	0.54	0.47	0.58	0.56	0.32	0.23	0.54	0.47	n/a	n/a
4-1/2	(114)	0.74	0.69	0.60	0.51	0.59	0.57	0.38	0.28	0.60	0.51	n/a	n/a
5	(127)	0.77	0.71	0.66	0.55	0.60	0.58	0.45	0.33	0.66	0.55	0.63	n/a
6	(152)	0.82	0.75	0.79	0.63	0.62	0.59	0.59	0.43	0.79	0.63	0.69	0.62
7	(178)	0.87	0.79	0.92	0.74	0.64	0.61	0.75	0.54	0.92	0.74	0.74	0.67
8	(203)	0.93	0.83	1.00	0.84	0.66	0.63	0.91	0.66	1.00	0.84	0.79	0.71
9	(229)	0.98	0.88		0.95	0.68	0.64	1.00	0.79		0.95	0.84	0.75
10	(254)	1.00	0.92		1.00	0.70	0.66		0.92		1.00	0.89	0.80
11	(279)		0.96			0.72	0.67		1.00			0.93	0.83
12	(305)		1.00			0.74	0.69					0.97	0.87
14	(356)					0.77	0.72					1.00	0.94
16	(406)					0.81	0.75						1.00
18	(457)					0.85	0.78						
20	(508)					0.89	0.82						
24	(610)					0.97	0.88						
> 30	(762)					1.00	0.97						

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 Appendix D.

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, this indicates that this specific edge distance may not be permitted with a certain spacing (or vice versa). Check with table 22 and figure 4 of this section to calculate permissable edge distance, spacing and concrete thickness combinations. Use of Hilti KWIK Bolt 3 anchors with edge distance and spacing dimensions smaller than what is noted in this table is permitted.

KWIK Bolt 3 Expansion Anchor 3.3.8

Table 25 - Load adjustment factors for 3/4-in. diameter KWIK Bolt 3 hot-dip galvanized anchor in uncracked concrete[1,2]

3/4-in. KB3 hot-dip galvanized 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				Conc. thickness factor in shear[4] f_{HV}	
									⊥ toward edge f_{RV}		II to edge f_{RV}			
Embedment h_{nom}			4-1/4	5-1/2	4-1/4	5-1/2	4-1/4	5-1/2	4-1/4	5-1/2	4-1/4	5-1/2	4-1/4	5-1/2
	in.	(mm)	(108)	(140)	(108)	(140)	(108)	(140)	(108)	(140)	(108)	(140)	(108)	(140)
Spacing (s) / edge distance (c_a) / concrete thickness (h) - in. (mm)	3-1/2	(89)	n/a	n/a	0.41	n/a	n/a	n/a	0.22	n/a	0.41	n/a	n/a	n/a
	3-5/8	(92)	n/a	n/a	0.42	0.49	n/a	n/a	0.23	0.16	0.42	0.32	n/a	n/a
	3-7/8	(98)	n/a	0.63	0.44	0.51	n/a	0.55	0.26	0.18	0.44	0.35	n/a	n/a
	4	(102)	0.68	0.63	0.45	0.52	0.57	0.55	0.27	0.18	0.45	0.37	n/a	n/a
	4-1/2	(114)	0.70	0.65	0.49	0.56	0.58	0.56	0.32	0.22	0.49	0.44	n/a	n/a
	5	(127)	0.72	0.67	0.53	0.59	0.59	0.57	0.38	0.26	0.53	0.52	n/a	n/a
	5-1/2	(140)	0.74	0.68	0.57	0.63	0.60	0.57	0.43	0.30	0.57	0.60	n/a	n/a
	6	(152)	0.77	0.70	0.62	0.67	0.60	0.58	0.49	0.34	0.62	0.67	0.65	n/a
	7	(178)	0.81	0.73	0.72	0.75	0.62	0.59	0.62	0.43	0.72	0.75	0.70	n/a
	8	(203)	0.86	0.77	0.82	0.84	0.64	0.61	0.76	0.52	0.82	0.84	0.75	0.66
	9	(229)	0.90	0.80	0.92	0.95	0.66	0.62	0.91	0.62	0.92	0.95	0.79	0.70
	10	(254)	0.94	0.83	1.00	1.00	0.67	0.64	1.00	0.73	1.00	1.00	0.83	0.74
	11	(279)	0.99	0.87			0.69	0.65		0.84			0.87	0.77
	12	(305)	1.00	0.90			0.71	0.66		0.96			0.91	0.81
	14	(356)		0.97			0.74	0.69		1.00			0.99	0.87
	16	(406)		1.00			0.78	0.72					1.00	0.93
	18	(457)					0.81	0.74						0.99
	20	(508)					0.85	0.77						1.00
	24	(610)					0.92	0.82						
	30	(762)					1.00	0.91						
	> 36	(914)						0.99						

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 Appendix D.

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, this indicates that this specific edge distance may not be permitted with a certain spacing (or vice versa). Check with table 22 and figure 4 of this section to calculate permissable edge distance, spacing and concrete thickness combinations. Use of Hilti KWIK Bolt 3 anchors with edge distance and spacing dimensions smaller than what is noted in this table is permitted.

3.3.8 KWIK Bolt 3 Expansion Anchor

Table 26 - Hilti KWIK Bolt 3 carbon steel design strength in the soffit of uncracked lightweight concrete over metal deck[1,2,3,4,5,6]

			Loads according to figure 5			
			Tension - ϕN_n		Shear - ϕV_n	
Nominal anchor diameter	Effective embed. in. (mm)	Nominal embed. in. (mm)	f'_c = 3000 psi lb (kN)	f'_c = 4000 psi lb (kN)	f'_c = 3000 psi lb (kN)	f'_c = 4000 psi lb (kN)
1/4	1-1/2 (38)	1-3/4 (44)	1,140 (5.1)	1,315 (5.8)	1,255 (5.6)	1,255 (5.6)
3/8	2 (51)	2-3/8 (60)	1,460 (6.5)	1,685 (7.5)	1,845 (8.2)	1,845 (8.2)
1/2	2 (51)	2-1/4 (57)	1,775 (7.9)	2,050 (9.1)	2,050 (9.1)	2,050 (9.1)
	3-1/4 (83)	3-1/2 (89)				
5/8	3-1/8 (79)	3-1/2 (89)	3,095 (13.8)	3,575 (15.9)	4,280 (19.0)	4,280 (19.0)
	4 (102)	4-3/8 (111)				

Table 27 - Hilti KWIK Bolt 3 stainless steel design strength in the soffit of uncracked lightweight concrete over metal deck[1,2,3,4,5,7]

			Loads according to figure 5			
			Tension - ϕN_n		Shear - ϕV_n	
Nominal anchor diameter	Effective embed. in. (mm)	Nominal embed. in. (mm)	f'_c = 3000 psi lb (kN)	f'_c = 4000 psi lb (kN)	f'_c = 3000 psi lb (kN)	f'_c = 4000 psi lb (kN)
1/4	1-1/2 (38)	1-3/4 (44)	1,175 (5.2)	1,355 (6.0)	1,315 (5.8)	1,315 (5.8)
3/8	2 (51)	2-3/8 (60)	1,675 (7.5)	1,935 (8.6)	1,675 (7.5)	1,675 (7.5)
1/2	2 (51)	2-1/4 (57)	1,265 (5.6)	1,460 (6.5)	1,135 (5.0)	1,135 (5.0)
	3-1/4 (83)	3-1/2 (89)				
5/8	3-1/8 (79)	3-1/2 (89)	2,880 (12.8)	3,325 (14.8)	3,700 (16.5)	3,700 (16.5)
	4 (102)	4-3/8 (111)				

[1] See section 3.1.7.3 to convert design strength value to ASD value.
[2] Linear interpolation between embedment depths and concrete compressive strengths is not permitted.
[3] Tabular value is for one anchor per flute. Minimum spacing along the length of the flute is 3 x h_{ef} (effective embedment).
[4] Tabular values are lightweight concrete and no additional reduction factor is needed.
[5] No additional reduction factors for spacing or edge distance need to be applied.
[6] Comparison to steel values in table 4 is not required. Values in tables 26 control.
[7] Comparison to steel values in table 12 is not required. Values in tables 27 control.

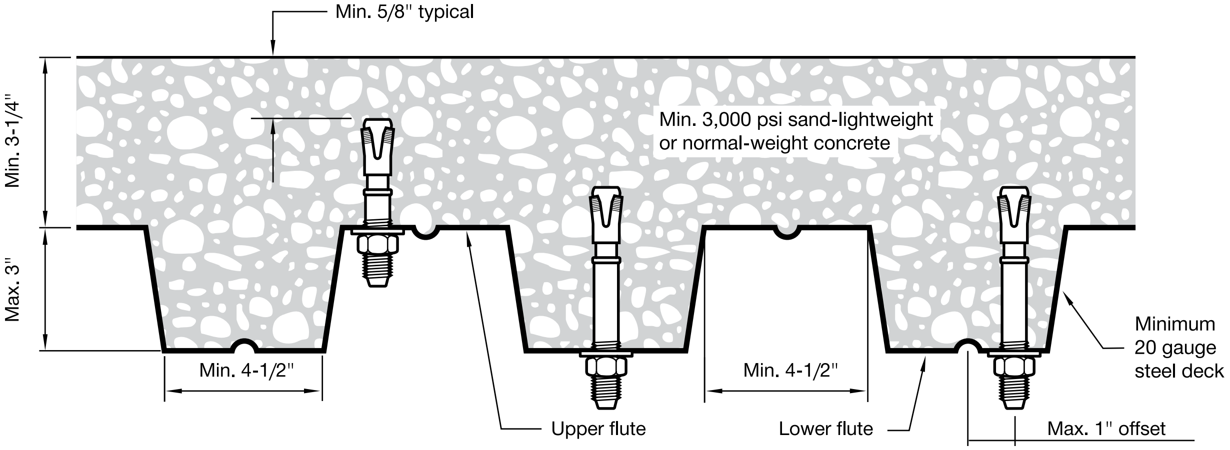


Figure 5 - Installation in concrete over metal deck

3.3.8.3.2 Technical data for masonry

Table 28 - KWIK Bolt 3 carbon steel allowable loads in grout-filled concrete masonry walls[1, 2, 3, 4, 5, 6]

Nominal anchor diameter	Nominal embedment in.	(mm)	Minimum distance from edge of block in.	(mm)	Tension lb	(kN)	Shear lb	(kN)
1/4	1-1/8	(29)	4	(102)	150	(0.7)	380	(1.7)
			12	(305)				
	2	(51)	4	(102)	540	(2.4)	445	(2.0)
			12	(305)				
3/8	1-5/8	(41)	4	(102)	320	(1.4)	735	(3.3)
			12	(305)	340	(1.5)	940	(4.2)
	2-1/2	(64)	4	(102)	780	(3.5)	1,010	(4.5)
			12	(305)			1,395	(6.2)
1/2	2-1/4	(57)	4	(102)	630	(2.8)	830	(3.7)
			12	(305)	665	(3.0)	1,465	(6.5)
	3-1/2	(89)	4	(102)	905	(4.0)	1,080	(4.8)
			12	(305)			2,375	(10.6)
5/8	2-3/4	(70)	4	(102)	815	(3.6)	890	(4.0)
			12	(305)	865	(3.8)	2,165	(9.6)
	4	(102)	4	(102)	1,240	(5.5)	970	(4.3)
			12	(305)	1,295	(5.8)	2,770	(12.3)
3/4	3-1/4	(83)	4	(102)	1,035	(4.6)	785	(3.5)
			12	(305)			3,135	(13.8)
	4-3/4	(121)	4	(102)	1,645	(7.3)	825	(3.7)
			12	(305)	1,710	(7.6)	3,305	(14.7)

Table 29 - KWIK Bolt 3 carbon steel allowable loads for anchors installed in top of grout-filled concrete masonry walls[1,6]

Nominal Anchor Diameter	Nominal Embedment		Tension		Shear			
					V_1		V_2	
	in.	(mm)	lb	(kN)	lb	(kN)	lb	(kN)
1/2	3	(76)	645	(2.9)	310	(1.4)	615	(2.7)
5/8	3-1/2	(89)	850	(3.8)	310	(1.4)	615	(2.7)

1 All values are for anchors installed in fully grouted concrete masonry with minimum masonry prism strength of 1,500 psi. Concrete masonry units may be lightweight, medium-weight or normal-weight conforming to ASTM C90. Allowable loads are calculated using safety factor of 4.

2 Anchors must be installed a minimum of 1-3/8 inch from any vertical mortar joint (see figure below).

3 Anchor locations are limited to one per masonry cell.

4 Embedment depth is measured from the outside face of the concrete masonry unit.

5 Linear interpolation to determine load values at intermediate edge distances is permitted.

6 All allowable loads based on safety factor of 4.

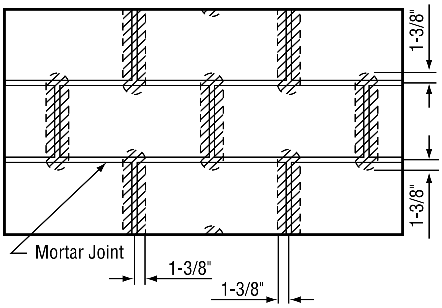


Figure 6 - Installation in grout-filled concrete masonry unit

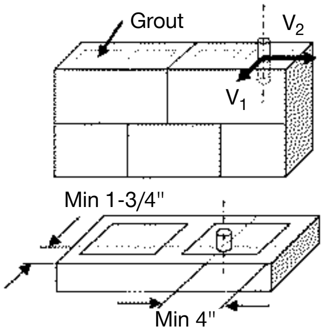


Figure 7 - KWIK Bolt 3 installed in the top of masonry walls

3.3.8.4 Installation instructions

Installation Instructions For Use (IFU) are included with each product package. They can also be viewed or downloaded online at www.us.hilti.com (US) and www.hilti.ca (Canada). 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.

3.3.8 KWIK Bolt 3 Expansion Anchor

3.3.8.5 Ordering Information

KWIK Bolt 3 anchor product line

	Length (ℓ)		Thread length (ℓ_{th})		ID stamp					
Size	in.	(mm)	in.	(mm)		Box	Carbon steel	304 SS	316 SS	HDG
1/4 x 1-3/4	1-3/4	(44)	3/4	(18)	A	100	●	●		
1/4 x 2-1/4	2-1/4	(57)	7/8	(22)	B		●	●	●	
1/4 x 3-1/4	3-1/4	(83)	2	(51)	D		●	●		
			7/8	(22)					●	
1/4 x 4-1/2	4-1/2	(114)	2-7/8	(75)	G		●	●		
3/8 x 2-1/4	2-1/4	(57)	7/8	(22)	B	50	●	●		
3/8 x 3	3	(76)	1-1/4	(32)	D				●	
			1-1/2	(40)			●	●		
3/8 x 3-3/4	3-3/4	(95)	1-1/4	(32)	E				●	
			2-1/4	(59)			●	●		
3/8 x 5	5	(127)	3-1/2	(91)	H		●	●		
3/8 x 7	7	(178)	5-1/2	(142)	L		●	●		
1/2 x 2-3/4	2-3/4	(70)	1-1/4	(33)	C	25	●	●		
1/2 x 3-3/4	3-3/4	(95)	1-5/16	(35)	E				●	
			2-3/16	(56)			●	●		●
1/2 x 4-1/2	4-1/2	(114)	1-5/16	(35)	G				●	
			2-7/8	(75)			●	●		●
1/2 x 5-1/2	5-1/2	(140)	1-5/16	(35)	I				●	
			3-3/4	(96)			●	●		●
1/2 x 7	7	(178)	4-3/4	(121)	L		●	●		●
5/8 x 3-3/4	3-3/4	(95)	1-1/2	(41)	E	15	●	●	●	
5/8 x 4-3/4	4-3/4	(121)	1-1/2	(41)	G				●	
			2-3/4	(70)			●	●		●
5/8 x 6	6	(152)	1-1/2	(41)	J			●	●	
			4	(102)			●			●
5/8 x 7	7	(178)	4-3/4	(121)			●			
5/8 x 8-1/2	8-1/2	(216)	6-1/2	(166)	O		●	●		
5/8 x 10	10	(254)	7	(180)	R		●	●		
3/4 x 4-3/4	4-3/4	(121)	1-1/2	(41)	G	20		●	●	
			2-7/16	(62)		10	●			●
						20		●		
3/4 x 5-1/2	5-1/2	(140)	1-1/2	(41)	I	20		●		
			3-7/16	(85)		10	●			●
						20		●		
3/4 x 7	7	(178)	1-1/2	(41)	L	10		●		
			4-5/8	(119)			●			
3/4 x 8	8	(203)	5-3/4	(146)	N		●	●		●
3/4 x 10	10	(254)	5-7/8	(152)	R		●	●	●	
3/4 x 12	12	(305)	5-7/8	(152)	T		●	●		
1 x 6	6	(152)	2-1/4	(57)	J	5	●	●	●	
1 x 9	9	(114)	2-1/4	(57)	P		●	●		
1 x 12	12	(114)	6	(152)	T		●	●		

Countersunk KWIK Bolt anchor product line

	Length				
Size	**in.**	(mm)	**Box**	**Carbon steel**	**304 SS**
C1/4 x 2	**2**	(51)	100	•	
C1/4 x 3	**3**	(76)	100	•	•
C1/4 x 5	**5**	(127)	100	•	
C3/8 x 2-1/4	**2-1/4**	(57)	100	•	
C3/8 x 3	**3**	(76)	100	•	
C3/8 x 4	**4**	(102)	50	•	•
C3/8 x 5	**5**	(127)	50	•	

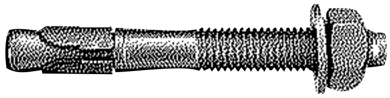
Rod Coupling KWIK Bolt 3 anchor product line

	Length		Thread length			
Size	**in.**	(mm)	**in.**	(mm)	**ID stamp**	**Box quantity**
3/8 x 2-1/4	**2-1/4**	(57)	**7/8**	(22)	B	100

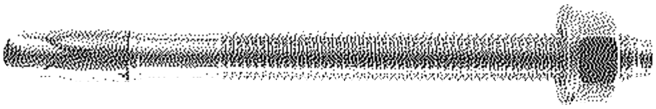
HHDCA ceiling anchor product line

	Length			
Size	**in.**	(mm)	**Eyelet size in.**	**Box quantity**
1/4 x 2	**2-1/32**	(52)	**5/16**	100

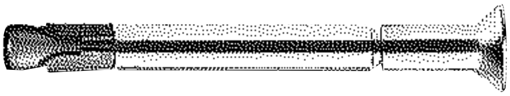
KWIK Bolt 3 anchor



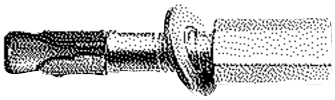
Long thread KWIK Bolt 3 anchor



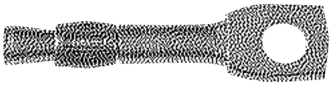
Countersunk KWIK Bolt 3 anchor



Rod coupling KWIK Bolt 3 anchor 3/8 x 2 1/4



HHDCA ceiling hanger 1/4 x 2



3.3.6.1 Product description

Hilti KWIK HUS-EZ (KH-EZ) anchors are comprised of a body with hex washer head. The anchor is manufactured from carbon steel and is heat treated. It has a minimum 0.0003 inch (8 μm) zinc coating in accordance with DIN EN ISO 4042. The KWIK HUS-EZ (KH-EZ) system is available in a variety of lengths with diameters of 1/4-, 3/8-, 1/2-, 5/8- and 3/4-in. The hex head is larger than the diameter of the anchor and is formed with serrations on the underside. The anchor body is formed with threads running most of the length of the anchor body. The anchor is installed in a predrilled hole with a powered impact wrench or torque wrench. The anchor threads cut into the concrete on the sides of the hole and interlock with the base material during installation. Applicable base materials include normal-weight concrete, structural lightweight concrete, lightweight concrete over metal deck, and grout-filled concrete masonry.

Guide specifications

Screw anchors shall be KWIK HUS-EZ as supplied by Hilti, Inc. Anchors shall be manufactured from heat treated carbon steel material, zinc plated to a minimum thickness of 8 μm. Anchor head shall display name of manufacturer, product name, diameter and length. Anchors shall be installed using a drill bit of same nominal diameter as anchor.

Product features

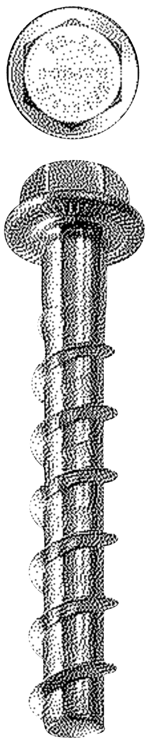
- Suitable for seismic and nonseismic loads.
- Quick and easy to install.
- Length and diameter identification clearly stamped on head facilitates quality control and inspection after installation.
- Through fixture installation improves productivity and accurate installation.
- Thread design enables quality setting and exceptional load values in wide variety of base material strengths.
- Anchor is fully removable
- Anchor size is same as drill bit size and uses standard diameter drill bits.
- Suitable for reduced edge distances and spacing.

3.3.6.2 Material specifications

Hilti KWIK HUS-EZ anchors are manufactured from carbon steel. The anchors are bright zinc plated to a minimum thickness of 8 μm.

3.3.6.3 Technical data

The technical data contained in this section are Hilti Simplified Design Tables. The load values were developed using the Strength Design parameters and variables of ESR-3027 and the equations within ACI 318 Appendix D. For a detailed explanation of the Hilti Simplified Design Method, refer to section 3.1.7. Data tables from ESR-3027 are not contained in this section, but can be found on www.icc-es.org or at www.us.hilti.com.



Listings/Approvals

ICC-ES (International Code Council)
ESR-3027
Cracked and Uncracked Concrete
ESR-3056
Grout-filled concrete masonry
City of Los Angeles
Research Report No. 25897

Independent code evaluation

IBC® / IRC® 2012
IBC® / IRC® 2009
IBC® / IRC® 2006
IBC® / IRC® 2003

3.3.6 KWIK HUS-EZ (KH-EZ) Carbon Steel Screw Anchor

Table 1 - KWIK HUS-EZ specifications[1]

Setting information	Symbol	Units	Nominal anchor diameter											
			1/4		3/8			1/2			5/8		3/4	
Nominal bit diameter	d_{bit}		1/4		3/8			1/2			5/8		3/4	
Minimum nominal embedment	h_{nom}	in.	1-5/8	2-1/2	1-5/8	2-1/2	3-1/4	2-1/4	3	4-1/4	3-1/4	5	4	6-1/4
Minimum effective embedment	h_{ef}	in.	1.18	1.92	1.11	1.86	2.50	1.50	2.16	3.22	2.39	3.88	2.92	4.84
Minimum hole depth	h_o	in.	2	2-7/8	1-7/8	2-3/4	3-1/2	2-5/8	3-3/8	4-5/8	3-5/8	5-3/8	4-4/8	6-5/8
Fixture hole diameter	d_h	in.	3/8		1/2			5/8			3/4		7/8	
Anchor Length = h_{nom} + t	ℓ		See ordering information											
Installation torque	T_{inst}	ft-lb	18		19	40		45			85		115	
		(Nm)	(24)		(26)	(54)		(61)			(115)		(155)	
Maximum impact wrench torque rating[2]	$T_{impact,max}$	ft-lb	114	137	114	450		137	450		450		450	
		(Nm)	(154)	(185)	(154)	(608)		(185)	(608)		(608)		(608)	
Wrench size		in.	7/16		9/16			3/4			15/16		1-1/8	

1 T_{inst} is the maximum installation torque that may be applied with a torque wrench.

2 Because of variability in measurement procedures, the published torque of an impact tool may not correlate properly with the above setting torques. Over torquing can damage the anchor and/or reduce its holding capacity.

Figure 1 - KWIK HUS-EZ specifications

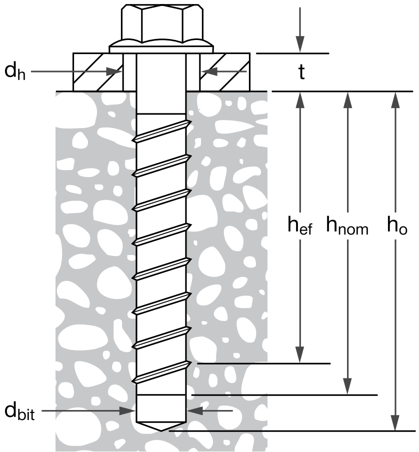


Table 2 - Hilti KWIK HUS-EZ design strength with concrete / pullout failure in uncracked concrete[1,2,3,4]

Nominal anchor diameter	Nominal embed. in. (mm)	Tension - ϕN_n				Shear - ϕV_n			
		f'_c = 2500 psi lb (kN)	f'_c = 3000 psi lb (kN)	f'_c = 4000 psi lb (kN)	f'_c = 6000 psi lb (kN)	f'_c = 2500 psi lb (kN)	f'_c = 3000 psi lb (kN)	f'_c = 4000 psi lb (kN)	f'_c = 6000 psi lb (kN)
1/4	1-5/8 (41)	585 (2.6)	620 (2.8)	675 (3.0)	765 (3.4)	1,075 (4.8)	1,180 (5.2)	1,360 (6.0)	1,670 (7.4)
	2-1/2 (64)	1,525 (6.8)	1,670 (7.4)	1,930 (8.6)	2,365 (10.5)	2,235 (9.9)	2,450 (10.9)	2,825 (12.6)	3,460 (15.4)
3/8	1-5/8 (41)	910 (4.0)	1,000 (4.4)	1,155 (5.1)	1,415 (6.3)	980 (4.4)	1,075 (4.8)	1,245 (5.5)	1,520 (6.8)
	2-1/2 (64)	1,980 (8.8)	2,165 (9.6)	2,505 (11.1)	3,065 (13.6)	2,130 (9.5)	2,335 (10.4)	2,695 (12.0)	3,300 (14.7)
	3-1/4 (83)	3,085 (13.7)	3,375 (15.0)	3,900 (17.3)	4,775 (21.2)	6,640 (29.5)	7,275 (32.4)	8,400 (37.4)	10,290 (45.8)
1/2	2-1/4 (57)	1,645 (7.3)	1,800 (8.0)	2,080 (9.3)	2,550 (11.3)	1,770 (7.9)	1,940 (8.6)	2,240 (10.0)	2,745 (12.2)
	3 (76)	2,785 (12.4)	3,050 (13.6)	3,525 (15.7)	4,315 (19.2)	3,000 (13.3)	3,285 (14.6)	3,795 (16.9)	4,645 (20.7)
	4-1/4 (108)	5,070 (22.6)	5,555 (24.7)	6,415 (28.5)	7,855 (34.9)	10,920 (48.6)	11,965 (53.2)	13,815 (61.5)	16,920 (75.3)
5/8	3-1/4 (83)	3,240 (14.4)	3,550 (15.8)	4,100 (18.2)	5,025 (22.4)	3,490 (15.5)	3,825 (17.0)	4,415 (19.6)	5,410 (24.1)
	5 (127)	6,705 (29.8)	7,345 (32.7)	8,485 (37.7)	10,390 (46.2)	14,445 (64.3)	15,825 (70.4)	18,270 (81.3)	22,380 (99.6)
3/4	4 (102)	4,380 (19.5)	4,795 (21.3)	5,540 (24.6)	6,785 (30.2)	9,430 (41.9)	10,330 (45.9)	11,930 (53.1)	14,610 (65.0)
	6-1/4 (159)	9,345 (41.6)	10,235 (45.5)	11,820 (52.6)	14,475 (64.4)	20,125 (89.5)	22,045 (98.1)	25,455 (113.2)	31,175 (138.7)

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

Nominal anchor diameter	Nominal embed. in. (mm)	Tension - ϕN_n				Shear - ϕV_n			
		f'_c = 2500 psi lb (kN)	f'_c = 3000 psi lb (kN)	f'_c = 4000 psi lb (kN)	f'_c = 6000 psi lb (kN)	f'_c = 2500 psi lb (kN)	f'_c = 3000 psi lb (kN)	f'_c = 4000 psi lb (kN)	f'_c = 6000 psi lb (kN)
1/4	1-5/8 (41)	300 (1.3)	315 (1.4)	345 (1.5)	390 (1.7)	765 (3.4)	835 (3.7)	965 (4.3)	1,180 (5.2)
	2-1/2 (64)	760 (3.4)	830 (3.7)	960 (4.3)	1,175 (5.2)	1,585 (7.1)	1,735 (7.7)	2,000 (8.9)	2,450 (10.9)
3/8	1-5/8 (41)	475 (2.1)	520 (2.3)	600 (2.7)	730 (3.2)	695 (3.1)	760 (3.4)	880 (3.9)	1,080 (4.8)
	2-1/2 (64)	1,400 (6.2)	1,535 (6.8)	1,775 (7.9)	2,170 (9.7)	1,510 (6.7)	1,655 (7.4)	1,910 (8.5)	2,340 (10.4)
	3-1/4 (83)	2,185 (9.7)	2,390 (10.6)	2,765 (12.3)	3,385 (15.1)	4,705 (20.9)	5,155 (22.9)	5,950 (26.5)	7,285 (32.4)
1/2	2-1/4 (57)	1,035 (4.6)	1,135 (5.0)	1,310 (5.8)	1,605 (7.1)	1,115 (5.0)	1,220 (5.4)	1,410 (6.3)	1,725 (7.7)
	3 (76)	1,755 (7.8)	1,920 (8.5)	2,220 (9.9)	2,715 (12.1)	1,890 (8.4)	2,070 (9.2)	2,390 (10.6)	2,925 (13.0)
	4-1/4 (108)	3,190 (14.2)	3,495 (15.5)	4,040 (18.0)	4,945 (22.0)	6,875 (30.6)	7,530 (33.5)	8,695 (38.7)	10,650 (47.4)
5/8	3-1/4 (83)	2,040 (9.1)	2,235 (9.9)	2,580 (11.5)	3,165 (14.1)	2,200 (9.8)	2,410 (10.7)	2,780 (12.4)	3,405 (15.1)
	5 (127)	4,225 (18.8)	4,625 (20.6)	5,340 (23.8)	6,540 (29.1)	9,095 (40.5)	9,965 (44.3)	11,505 (51.2)	14,090 (62.7)
3/4	4 (102)	2,755 (12.3)	3,020 (13.4)	3,485 (15.5)	4,270 (19.0)	5,940 (26.4)	6,505 (28.9)	7,510 (33.4)	9,200 (40.9)
	6-1/4 (159)	5,885 (26.2)	6,445 (28.7)	7,440 (33.1)	9,115 (40.5)	12,670 (56.4)	13,880 (61.7)	16,030 (71.3)	19,630 (87.3)

1 See section 3.1.7.3 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 table 6 to 15 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. For seismic loads, multiply cracked concrete tabular values by the following reduction factors:
1/4-in diameter by 1-5/8-in nominal embedment depth - α_{seis} = 0.60
All other sizes - α_{seis} = 0.75
See section 3.1.7.4 for additional information on seismic applications.

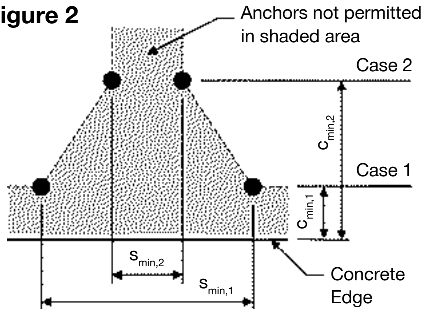
3.3.6 KWIK HUS-EZ (KH-EZ) Carbon Steel Screw Anchor

Table 4 - Steel design strength for Hilti KWIK HUS-EZ anchors[1,2]

Nominal anchor diameter	Nominal embedment in. (mm)			Tensile[3] ϕN_{sa} lb (kN)	Shear[4] ϕV_{sa} lb (kN)	Seismic shear[5] ϕV_{sa} lb (kN)
1/4	1-5/8 (41)	2-1/2 (64)		3,945 (17.5)	930 (4.1)	835 (3.7)
3/8	1-5/8 (41)			5,980 (26.6)	2,200 (9.8)	2,200 (9.8)
	2-1/2 (64)	3-1/4 (83)		6,720 (29.9)	3,110 (13.8)	1,865 (8.3)
1/2	2-1/4 (57)	3 (76)	4-1/4 (108)	11,780 (52.4)	5,545 (24.7)	3,330 (14.8)
5/8	3-1/4 (83)	5 (127)		15,735 (70.0)	6,735 (30.0)	4,040 (18.0)
3/4	4 (102)	6-1/4 (159)		20,810 (92.6)	9,995 (44.5)	6,935 (30.8)

1 See section 3.1.7.3 to convert design strength value to ASD value.
2 KWIK HUS-EZ anchors are to be considered brittle steel elements.
3 Tensile $\phi N_{sa} = \phi A_{se,N} f_{uta}$ as noted in ACI 318 Appendix D.
4 Shear values determined by static shear tests with $\phi V_{sa} < \phi 0.60 A_{se,V} f_{uta}$ as noted in ACI 318 Appendix D.
5 Seismic shear values determined by seismic shear tests with $\phi V_{sa} \leq \phi\ 0.60 A_{se,V} f_{uta}$ as noted in ACI 318 Appendix D. See section 3.1.7.4 for additional information on seismic applications.

Figure 2



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

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

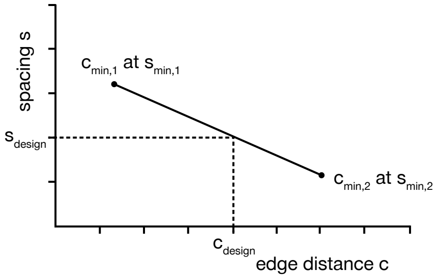


Table 5 - KWIK HUS-EZ installation parameters

Setting information	Symbol	Units	Nominal anchor diameter											
			1/4		3/8			1/2			5/8		3/4	
Effective minimum embedment	h_{ef}	in.	1.18	1.92	1.11	1.86	2.50	1.50	2.16	3.22	2.39	3.88	2.92	4.84
Minimum member thickness	h_{min}	in.	3-1/4	4.125	3-1/4	4	4-7/8	4-1/2	4 3/4	6-3/4	5	7	6	8-1/8
Case 1	$c_{min,1}$	in.	2	2.78	2.63	2.92	3.75	2.75	3.75	5.25	3.63	5.81	4.41	7.28
	for $s_{min,1} \geq$	in.	1.50		2.25			3						
Case 2	$c_{min,2}$	in.	1.50					1.75						
	for $s_{min,2} \geq$	in.	3								4			

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 spacings.

KWIK HUS-EZ (KH-EZ) Carbon Steel Screw Anchor 3.3.6

Table 6 - Load adjustment factors for 1/4-in. diameter KWIK HUS-EZ in uncracked concrete[1,2]

1/4-in. KH-EZ 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				Conc. thickness factor in shear[4] f_{HV}	
									⊥ toward edge f_{RV}		II to edge f_{RV}			
Embedment h_{nom}		in. (mm)	1-5/8 (41)	2-1/2 (64)	1-5/8 (41)	2-1/2 (64)	1-5/8 (41)	2-1/2 (64)	1-5/8 (41)	2-1/2 (64)	1-5/8 (41)	2-1/2 (64)	1-5/8 (41)	2-1/2 (64)
Spacing (s)/edge distance (c_a)/concrete thickness (h) - in. (mm)	1-1/2	(38)	0.71	0.63	0.78	0.65	0.59	0.56	0.40	0.21	0.78	0.42	n/a	n/a
	2	(51)	0.78	0.67	1.00	0.77	0.62	0.58	0.61	0.33	1.00	0.65	n/a	n/a
	2-1/2	(64)	0.85	0.72		0.90	0.65	0.60	0.86	0.46		0.90	n/a	n/a
	3	(76)	0.92	0.76		1.00	0.68	0.62	1.00	0.60		1.00	n/a	n/a
	3-1/4	(83)	0.96	0.78			0.70	0.63		0.68			0.88	n/a
	3-1/2	(89)	0.99	0.80			0.71	0.64		0.76			0.92	n/a
	4	(102)	1.00	0.85			0.74	0.66		0.92			0.98	n/a
	4-1/8	(105)		0.86			0.75	0.66		0.97			1.00	0.81
	4-1/2	(114)		0.89			0.77	0.68		1.00				0.84
	5	(127)		0.93			0.80	0.70						0.89
	5-1/2	(140)		0.98			0.83	0.72						0.93
	6	(152)		1.00			0.86	0.74						0.97
	7	(178)					0.92	0.78						1.00
	8	(203)					0.98	0.82						
	9	(229)					1.00	0.86						
	10	(254)						0.89						
	11	(279)						0.93						
	12	(305)						0.97						
	14	(356)						1.00						

Table 7 - Load adjustment factors for 1/4-in. diameter KWIK HUS-EZ in cracked concrete[1,2]

1/4-in. KH-EZ 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				Conc. thickness factor in shear[4] f_{HV}	
									⊥ toward edge f_{RV}		II to edge f_{RV}			
Embedment h_{nom}		in. (mm)	1-5/8 (41)	2-1/2 (64)	1-5/8 (41)	2-1/2 (64)	1-5/8 (41)	2-1/2 (64)	1-5/8 (41)	2-1/2 (64)	1-5/8 (41)	2-1/2 (64)	1-5/8 (41)	2-1/2 (64)
Spacing (s)/edge distance (c_a)/concrete thickness (h) - in. (mm)	1-1/2	(38)	0.71	0.63	0.88	0.65	0.59	0.56	0.40	0.21	0.80	0.43	n/a	n/a
	2	(51)	0.78	0.67	1.00	0.77	0.62	0.58	0.62	0.33	1.00	0.66	n/a	n/a
	2-1/2	(64)	0.85	0.72		0.90	0.65	0.60	0.87	0.46		0.90	n/a	n/a
	3	(76)	0.92	0.76		1.00	0.68	0.62	1.00	0.60		1.00	n/a	n/a
	3-1/4	(83)	0.96	0.78			0.70	0.63		0.68			0.89	n/a
	3-1/2	(89)	0.99	0.80			0.71	0.64		0.76			0.92	n/a
	4	(102)	1.00	0.85			0.74	0.66		0.93			0.98	n/a
	4-1/8	(105)		0.86			0.75	0.66		0.97			1.00	0.81
	4-1/2	(114)		0.89			0.77	0.68		1.00				0.85
	5	(127)		0.93			0.80	0.70						0.89
	5-1/2	(140)		0.98			0.83	0.72						0.93
	6	(152)		1.00			0.86	0.74						0.98
	7	(178)					0.92	0.78						1.00
	8	(203)					0.98	0.82						
	9	(229)					1.00	0.86						
	10	(254)						0.90						
	11	(279)						0.94						
	12	(305)						0.98						
	14	(356)						1.00						

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 Appendix D.

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, this indicates that this specific edge distance may not be permitted with a certain spacing (or vice versa). Check with table 5 and figure 2 of this section to calculate permissable edge distance, spacing and concrete thickness combinations.

3.3.6 KWIK HUS-EZ (KH-EZ) Carbon Steel Screw Anchor

Table 8 - Load adjustment factors for 3/8-in. diameter KWIK HUS-EZ in uncracked concrete[1,2]

3/8-in. KH-EZ 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 edge f_{RV}			Conc. thickness factor in shear[4] f_{HV}		
Embedment h_{nom}		in.	1-5/8	2-1/2	3-1/4	1-5/8	2-1/2	3-1/4	1-5/8	2-1/2	3-1/4	1-5/8	2-1/2	3-1/4	1-5/8	2-1/2	3-1/4	1-5/8	2-1/2	3-1/4
		(mm)	(41)	(64)	(83)	(41)	(64)	(83)	(41)	(64)	(83)	(41)	(64)	(83)	(41)	(64)	(83)	(41)	(64)	(83)
Spacing (s)/edge distance (c_a)/concrete thickness (h) - in. (mm)	1-1/2	(38)	n/a	n/a	n/a	0.58	0.63	0.57	n/a	n/a	n/a	0.49	0.25	0.08	0.58	0.50	0.17	n/a	n/a	n/a
	2	(51)	n/a	n/a	n/a	0.76	0.75	0.66	n/a	n/a	n/a	0.75	0.38	0.13	0.76	0.75	0.26	n/a	n/a	n/a
	2-1/4	(57)	0.84	0.70	0.65	0.86	0.81	0.70	0.65	0.60	0.55	0.90	0.46	0.16	0.90	0.81	0.31	n/a	n/a	n/a
	2-1/2	(64)	0.88	0.72	0.67	0.95	0.88	0.75	0.67	0.61	0.55	1.00	0.54	0.18	1.00	0.88	0.37	n/a	n/a	n/a
	3	(76)	0.95	0.77	0.70	1.00	1.00	0.85	0.71	0.63	0.56	1.00	0.71	0.24	1.00	1.00	0.48	n/a	n/a	n/a
	3-1/4	(83)	0.99	0.79	0.72			0.90	0.72	0.64	0.57		0.80	0.27			0.54	0.95	n/a	n/a
	3-1/2	(89)	1.00	0.81	0.73			0.95	0.74	0.65	0.58		0.89	0.30			0.61	0.98	n/a	n/a
	4	(102)		0.86	0.77			1.00	0.78	0.68	0.59		1.00	0.37			0.74	1.00	0.84	n/a
	4-1/2	(114)		0.90	0.80				0.81	0.70	0.60			0.44			0.88		0.89	n/a
	4-3/4	(121)		0.93	0.82				0.83	0.71	0.60			0.48			0.96		0.91	0.64
	5	(127)		0.95	0.83				0.84	0.72	0.61			0.52			1.00		0.94	0.66
	6	(152)		1.00	0.90				0.91	0.76	0.63			0.68					1.00	0.72
	7	(178)			0.97				0.98	0.81	0.65			0.86						0.78
	8	(203)			1.00				1.00	0.85	0.67			1.00						0.83
	9	(229)								0.90	0.69									0.88
	10	(254)								0.94	0.71									0.93
	11	(279)								0.98	0.74									0.97
	12	(305)								1.00	0.76									1.00
	14	(356)									0.80									
	16	(406)									0.84									
	18	(457)									0.89									
	20	(508)									0.93									
	24	(610)									1.00									

Table 9 - Load adjustment factors for 3/8-in. diameter KWIK HUS-EZ in cracked concrete[1,2]

3/8-in. KH-EZ 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 edge f_{RV}			Conc. thickness factor in shear[4] f_{HV}		
Embedment h_{nom}		in.	1-5/8	2-1/2	3-1/4	1-5/8	2-1/2	3-1/4	1-5/8	2-1/2	3-1/4	1-5/8	2-1/2	3-1/4	1-5/8	2-1/2	3-1/4	1-5/8	2-1/2	3-1/4
		(mm)	(41)	(64)	(83)	(41)	(64)	(83)	(41)	(64)	(83)	(41)	(64)	(83)	(41)	(64)	(83)	(41)	(64)	(83)
Spacing (s)/edge distance (c_a)/concrete thickness (h) - in. (mm)	1-1/2	(38)	n/a	n/a	n/a	0.92	0.66	0.57	n/a	n/a	n/a	0.49	0.25	0.09	0.92	0.50	0.17	n/a	n/a	n/a
	2	(51)	n/a	n/a	n/a	1.00	0.79	0.66	n/a	n/a	n/a	0.76	0.39	0.13	1.00	0.77	0.26	n/a	n/a	n/a
	2-1/4	(57)	0.84	0.70	0.65	1.00	0.85	0.70	0.66	0.60	0.55	0.90	0.46	0.16	1.00	0.85	0.31	n/a	n/a	n/a
	2-1/2	(64)	0.88	0.72	0.67	1.00	0.92	0.75	0.67	0.61	0.55	1.00	0.54	0.18	1.00	0.92	0.37	n/a	n/a	n/a
	3	(76)	0.95	0.77	0.70	1.00	1.00	0.85	0.71	0.63	0.56	1.00	0.71	0.24	1.00	1.00	0.48	n/a	n/a	n/a
	3-1/4	(83)	0.99	0.79	0.72			0.90	0.73	0.64	0.57		0.80	0.27			0.55	0.95	n/a	n/a
	3-1/2	(89)	1.00	0.81	0.73			0.95	0.74	0.65	0.58		0.90	0.31			0.61	0.98	n/a	n/a
	4	(102)		0.86	0.77			1.00	0.78	0.68	0.59		1.00	0.37			0.75	1.00	0.84	n/a
	4-1/2	(114)		0.90	0.80				0.81	0.70	0.60			0.44			0.89		0.89	n/a
	4-3/4	(121)		0.93	0.82				0.83	0.71	0.60			0.48			0.97		0.92	0.64
	5	(127)		0.95	0.83				0.85	0.72	0.61			0.52			1.00		0.94	0.66
	6	(152)		1.00	0.90				0.92	0.77	0.63			0.69					1.00	0.72
	7	(178)			0.97				0.98	0.81	0.65			0.86						0.78
	8	(203)			1.00				1.00	0.85	0.67			1.00						0.83
	9	(229)								0.90	0.69									0.88
	10	(254)								0.94	0.72									0.93
	11	(279)								0.99	0.74									0.97
	12	(305)								1.00	0.76									1.00
	14	(356)									0.80									
	16	(406)									0.85									
	18	(457)									0.89									
	20	(508)									0.93									
	24	(610)									1.00									

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 Appendix D.

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, this indicates that this specific edge distance may not be permitted with a certain spacing (or vice versa). Check table 5 and figure 2 of this section to calculate permissable edge distance, spacing and concrete thickness combinations.

Table 10 - Load adjustment factors for 1/2-in. diameter KWIK HUS-EZ in uncracked concrete[1,2]

1/2-in. KH-EZ 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 edge f_{RV}			Conc. thickness factor in shear[4] f_{HV}		
Embedment h_{nom}		in.	2-1/4	3	4-1/4	2-1/4	3	4-1/4	2-1/4	3	4-1/4	2-1/4	3	4-1/4	2-1/4	3	4-1/4	2-1/4	3	4-1/4
		(mm)	(57)	(76)	(108)	(57)	(76)	(108)	(57)	(76)	(108)	(57)	(76)	(108)	(57)	(76)	(108)	(57)	(76)	(108)
Spacing (s)/edge distance (c_a)/concrete thickness (h) - in. (mm)	1-3/4	(44)	n/a	n/a	n/a	0.68	0.57	0.51	n/a	n/a	n/a	0.40	0.25	0.07	0.68	0.50	0.15	n/a	n/a	n/a
	2	(51)	n/a	n/a	n/a	0.75	0.62	0.54	n/a	n/a	n/a	0.48	0.31	0.09	0.75	0.61	0.18	n/a	n/a	n/a
	2-1/2	(64)	n/a	n/a	n/a	0.91	0.71	0.60	n/a	n/a	n/a	0.68	0.43	0.13	0.91	0.71	0.25	n/a	n/a	n/a
	3	(76)	0.83	0.73	0.66	1.00	0.81	0.66	0.65	0.61	0.55	0.89	0.56	0.17	1.00	0.81	0.33	n/a	n/a	n/a
	3-1/2	(89)	0.88	0.77	0.68		0.93	0.73	0.68	0.63	0.56	1.00	0.71	0.21		0.93	0.42	n/a	n/a	n/a
	4	(102)	0.94	0.81	0.71		1.00	0.80	0.71	0.65	0.57		0.87	0.26		1.00	0.52	n/a	n/a	n/a
	4-1/2	(114)	0.99	0.85	0.73			0.87	0.73	0.67	0.58		1.00	0.31			0.62	0.96	n/a	n/a
	4-3/4	(121)	1.00	0.87	0.75			0.91	0.74	0.68	0.58			0.33			0.67	0.99	0.85	n/a
	5	(127)		0.89	0.76			0.95	0.76	0.69	0.58			0.36			0.72	1.00	0.87	n/a
	6	(152)		0.96	0.81			1.00	0.81	0.73	0.60			0.47			0.95		0.95	n/a
	6-3/4	(171)		1.00	0.85				0.85	0.76	0.61			0.57			1.00		1.00	0.68
	7	(178)			0.86				0.86	0.77	0.62			0.60						0.69
	8	(203)			0.91				0.91	0.80	0.64			0.73						0.73
	9	(229)			0.97				0.96	0.84	0.65			0.87						0.78
	10	(254)			1.00				1.00	0.88	0.67			1.00						0.82
	11	(279)								0.92	0.69									0.86
	12	(305)								0.95	0.70									0.90
	14	(356)								1.00	0.74									0.97
	16	(406)									0.77									1.00
	18	(457)									0.80									
	20	(508)									0.84									
	> 24	(610)									0.91									

Table 11 - Load adjustment factors for 1/2-in. diameter KWIK HUS-EZ in cracked concrete[1,2]

1/2-in. KH-EZ 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 edge f_{RV}			Conc. thickness factor in shear[4] f_{HV}		
Embedment h_{nom}		in.	2-1/4	3	4-1/4	2-1/4	3	4-1/4	2-1/4	3	4-1/4	2-1/4	3	4-1/4	2-1/4	3	4-1/4	2-1/4	3	4-1/4
		(mm)	(57)	(76)	(108)	(57)	(76)	(108)	(57)	(76)	(108)	(57)	(76)	(108)	(57)	(76)	(108)	(57)	(76)	(108)
Spacing (s)/edge distance (c_a)/concrete thickness (h) - in. (mm)	1-3/4	(44)	n/a	n/a	n/a	0.82	0.66	0.55	n/a	n/a	n/a	0.45	0.28	0.08	0.82	0.57	0.17	n/a	n/a	n/a
	2	(51)	n/a	n/a	n/a	0.90	0.72	0.58	n/a	n/a	n/a	0.55	0.35	0.10	0.90	0.70	0.21	n/a	n/a	n/a
	2-1/2	(64)	n/a	n/a	n/a	1.00	0.83	0.65	n/a	n/a	n/a	0.77	0.49	0.14	1.00	0.83	0.29	n/a	n/a	n/a
	3	(76)	0.83	0.73	0.66	1.00	0.94	0.72	0.67	0.62	0.56	1.00	0.64	0.19	1.00	0.94	0.38	n/a	n/a	n/a
	3-1/2	(89)	0.88	0.77	0.68		1.00	0.79	0.70	0.64	0.56		0.80	0.24		1.00	0.48	n/a	n/a	n/a
	4	(102)	0.94	0.81	0.71		1.00	0.87	0.72	0.66	0.57		0.98	0.29		1.00	0.59	n/a	n/a	n/a
	4-1/2	(114)	0.99	0.85	0.73			0.95	0.75	0.69	0.58		1.00	0.35			0.70	1.00	n/a	n/a
	4-3/4	(121)	1.00	0.87	0.75			0.99	0.77	0.70	0.59			0.38			0.76		0.88	n/a
	5	(127)		0.89	0.76			1.00	0.78	0.71	0.59			0.41			0.82		0.91	n/a
	6	(152)		0.96	0.81			1.00	0.84	0.75	0.61			0.54			1.00		0.99	n/a
	6-3/4	(171)		1.00	0.85				0.88	0.78	0.62			0.64					1.00	0.70
	7	(178)			0.86				0.89	0.79	0.63			0.68						0.72
	8	(203)			0.91				0.95	0.83	0.65			0.83						0.77
	9	(229)			0.97				1.00	0.87	0.67			0.99						0.81
	10	(254)			1.00					0.91	0.68			1.00						0.86
	11	(279)								0.95	0.70									0.90
	12	(305)								0.99	0.72									0.94
	14	(356)								1.00	0.76									1.00
	16	(406)									0.79									
	18	(457)									0.83									
	20	(508)									0.87									
	> 24	(610)									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 Appendix D.

[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, this indicates that this specific edge distance may not be permitted with a certain spacing (or vice versa). Check table 5 and figure 2 of this section to calculate permissable edge distance, spacing and concrete thickness combinations.

3.3.6 KWIK HUS-EZ (KH-EZ) Carbon Steel Screw Anchor

Table 12 - Load adjustment factors for 5/8-in. diameter KWIK HUS-EZ in uncracked concrete[1,2]

5/8-in. KH-EZ 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				Conc. thickness factor in shear[4] f_{HV}	
									⊥ toward edge f_{RV}		II to edge f_{RV}			
Embedment h_{nom}	in.	(mm)	3-1/4 (83)	5 (127)	3-1/4 (83)	5 (127)	3-1/4 (83)	5 (127)	3-1/4 (83)	5 (127)	3-1/4 (83)	5 (127)	3-1/4 (83)	5 (127)
Spacing (s)/edge distance (c_a)/concrete thickness (h) - in. (mm)	1-3/4	(44)	n/a	n/a	0.62	0.51	n/a	n/a	0.24	0.06	0.47	0.13	n/a	n/a
	2	(51)	n/a	n/a	0.67	0.54	n/a	n/a	0.29	0.08	0.57	0.15	n/a	n/a
	2-1/2	(64)	n/a	n/a	0.76	0.59	n/a	n/a	0.40	0.11	0.76	0.21	n/a	n/a
	3	(76)	0.71	0.63	0.86	0.65	0.61	0.55	0.53	0.14	0.86	0.28	n/a	n/a
	3-1/2	(89)	0.74	0.65	0.97	0.70	0.63	0.55	0.66	0.18	0.97	0.35	n/a	n/a
	4	(102)	0.78	0.67	1.00	0.76	0.65	0.56	0.81	0.22	1.00	0.43	n/a	n/a
	4-1/2	(114)	0.81	0.69		0.83	0.66	0.57	0.97	0.26		0.52	n/a	n/a
	5	(127)	0.85	0.71		0.89	0.68	0.58	1.00	0.30		0.60	0.85	n/a
	5-1/2	(140)	0.88	0.74		0.96	0.70	0.58		0.35		0.70	0.89	n/a
	6	(152)	0.92	0.76		1.00	0.72	0.59		0.40		0.80	0.93	n/a
	7	(178)	0.99	0.80			0.75	0.61		0.50		1.00	1.00	0.65
	8	(203)	1.00	0.84			0.79	0.62		0.61				0.69
	9	(229)		0.89			0.83	0.64		0.73				0.74
	10	(254)		0.93			0.86	0.65		0.86				0.78
	11	(279)		0.97			0.90	0.67		0.99				0.81
	12	(305)		1.00			0.94	0.68		1.00				0.85
	14	(356)					1.00	0.71						0.92
	16	(406)						0.74						0.98
	18	(457)						0.77						1.00
	20	(508)						0.80						
	24	(610)						0.86						
	> 30	(762)						0.95						

Table 13 - Load adjustment factors for 5/8-in. diameter KWIK HUS-EZ in cracked concrete[1,2]

5/8-in. KH-EZ 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				Conc. thickness factor in shear[4] f_{HV}	
									⊥ toward edge f_{RV}		II to edge f_{RV}			
Embedment h_{nom}	in.	(mm)	3-1/4 (83)	5 (127)	3-1/4 (83)	5 (127)	3-1/4 (83)	5 (127)	3-1/4 (83)	5 (127)	3-1/4 (83)	5 (127)	3-1/4 (83)	5 (127)
Spacing (s)/edge distance (c_a)/concrete thickness (h) - in. (mm)	1-3/4	(44)	n/a	n/a	0.63	0.51	n/a	n/a	0.27	0.07	0.53	0.14	n/a	n/a
	2	(51)	n/a	n/a	0.68	0.54	n/a	n/a	0.33	0.09	0.65	0.17	n/a	n/a
	2-1/2	(64)	n/a	n/a	0.77	0.59	n/a	n/a	0.46	0.12	0.77	0.24	n/a	n/a
	3	(76)	0.71	0.63	0.87	0.65	0.62	0.55	0.60	0.16	0.87	0.32	n/a	n/a
	3-1/2	(89)	0.74	0.65	0.98	0.70	0.64	0.56	0.75	0.20	0.98	0.40	n/a	n/a
	4	(102)	0.78	0.67	1.00	0.76	0.66	0.57	0.92	0.25	1.00	0.49	n/a	n/a
	4-1/2	(114)	0.81	0.69		0.83	0.68	0.57	1.00	0.29		0.59	n/a	n/a
	5	(127)	0.85	0.71		0.89	0.70	0.58		0.34		0.69	0.89	n/a
	5-1/2	(140)	0.88	0.74		0.96	0.72	0.59		0.40		0.79	0.93	n/a
	6	(152)	0.92	0.76		1.00	0.74	0.60		0.45		0.90	0.97	n/a
	7	(178)	0.99	0.80			0.78	0.61		0.57		1.00	1.00	0.68
	8	(203)	1.00	0.84			0.82	0.63		0.69				0.72
	9	(229)		0.89			0.86	0.65		0.83				0.77
	10	(254)		0.93			0.89	0.66		0.97				0.81
	11	(279)		0.97			0.93	0.68		1.00				0.85
	12	(305)		1.00			0.97	0.70						0.89
	14	(356)					1.00	0.73						0.96
	16	(406)						0.76						1.00
	18	(457)						0.79						
	20	(508)						0.83						
	24	(610)						0.89						
	> 30	(762)						0.99						

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 Appendix D.

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, this indicates that this specific edge distance may not be permitted with a certain spacing (or vice versa). Check with table 5 and figure 2 of this section to calculate permissable edge distance, spacing and concrete thickness combinations.

Table 14 - Load adjustment factors for 3/4-in. diameter KWIK HUS-EZ in uncracked concrete[1,2]

3/4-in. KH-EZ 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 edge f_{RV}		Conc. thickness factor in shear[4] f_{HV}	
Embedment h_{nom}	in.	(mm)	4 (102)	6-1/4 (159)	4 (102)	6-1/4 (159)	4 (102)	6-1/4 (159)	4 (102)	6-1/4 (159)	4 (102)	6-1/4 (159)	4 (102)	6-1/4 (159)
Spacing (s)/edge distance (c_a)/concrete thickness (h) - in. (mm)	1-3/4	(44)	n/a	n/a	0.57	0.48	n/a	n/a	0.10	0.05	0.19	0.10	n/a	n/a
	2	(51)	n/a	n/a	0.61	0.50	n/a	n/a	0.12	0.06	0.23	0.12	n/a	n/a
	2-1/2	(64)	n/a	n/a	0.68	0.54	n/a	n/a	0.16	0.08	0.33	0.17	n/a	n/a
	3	(76)	0.67	0.60	0.76	0.58	0.56	0.54	0.21	0.11	0.43	0.22	n/a	n/a
	3-1/2	(89)	0.70	0.62	0.84	0.62	0.57	0.55	0.27	0.14	0.54	0.28	n/a	n/a
	4	(102)	0.73	0.64	0.93	0.67	0.58	0.55	0.33	0.17	0.66	0.34	n/a	n/a
	4-1/2	(114)	0.76	0.65	1.00	0.72	0.59	0.56	0.39	0.20	0.79	0.41	n/a	n/a
	5	(127)	0.79	0.67		0.76	0.60	0.56	0.46	0.24	0.92	0.48	n/a	n/a
	5-1/2	(140)	0.81	0.69		0.81	0.61	0.57	0.53	0.28	1.00	0.55	n/a	n/a
	6	(152)	0.84	0.71		0.86	0.62	0.58	0.61	0.31		0.63	0.69	n/a
	7	(178)	0.90	0.74		0.97	0.64	0.59	0.77	0.40		0.79	0.75	n/a
	8	(203)	0.96	0.78		1.00	0.66	0.60	0.94	0.48		0.97	0.80	n/a
	8-1/8	(206)	0.96	0.78			0.66	0.60	0.96	0.50		0.99	0.80	0.65
	9	(229)	1.00	0.81			0.68	0.62	1.00	0.58		1.00	0.85	0.68
	10	(254)		0.84			0.70	0.63		0.68			0.89	0.72
	11	(279)		0.88			0.72	0.64		0.78			0.94	0.75
	12	(305)		0.91			0.74	0.65		0.89			0.98	0.79
	14	(356)		0.98			0.78	0.68		1.00			1.00	0.85
	16	(406)		1.00			0.82	0.71						0.91
	18	(457)					0.86	0.73						0.96
	20	(508)					0.90	0.76						1.00
	24	(610)					0.98	0.81						
	30	(762)					1.00	0.89						
	> 36	(914)						0.96						

Table 15 - Load adjustment factors for 3/4-in. diameter KWIK HUS-EZ in cracked concrete[1,2]

3/4-in. KH-EZ 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 edge f_{RV}		Conc. thickness factor in shear[4] f_{HV}	
Embedment h_{nom}	in.	(mm)	4 (102)	6-1/4 (159)	4 (102)	6-1/4 (159)	4 (102)	6-1/4 (159)	4 (102)	6-1/4 (159)	4 (102)	6-1/4 (159)	4 (102)	6-1/4 (159)
Spacing (s)/edge distance (c_a)/concrete thickness (h) - in. (mm)	1-3/4	(44)	n/a	n/a	0.57	0.48	n/a	n/a	0.11	0.06	0.22	0.11	n/a	n/a
	2	(51)	n/a	n/a	0.61	0.50	n/a	n/a	0.13	0.07	0.27	0.14	n/a	n/a
	2-1/2	(64)	n/a	n/a	0.68	0.54	n/a	n/a	0.19	0.10	0.37	0.19	n/a	n/a
	3	(76)	0.67	0.60	0.76	0.58	0.57	0.54	0.24	0.13	0.49	0.25	n/a	n/a
	3-1/2	(89)	0.70	0.62	0.85	0.63	0.58	0.55	0.31	0.16	0.61	0.32	n/a	n/a
	4	(102)	0.73	0.64	0.93	0.67	0.59	0.56	0.38	0.19	0.75	0.39	n/a	n/a
	4-1/2	(114)	0.76	0.65	1.00	0.72	0.60	0.56	0.45	0.23	0.90	0.46	n/a	n/a
	5	(127)	0.79	0.67		0.77	0.61	0.57	0.52	0.27	1.00	0.54	n/a	n/a
	5-1/2	(140)	0.81	0.69		0.81	0.62	0.58	0.60	0.31		0.63	n/a	n/a
	6	(152)	0.84	0.71		0.87	0.63	0.58	0.69	0.36		0.71	0.72	n/a
	7	(178)	0.90	0.74		0.97	0.65	0.60	0.87	0.45		0.90	0.78	n/a
	8	(203)	0.96	0.78		1.00	0.67	0.61	1.00	0.55		1.00	0.83	n/a
	8-1/8	(206)	0.96	0.78			0.68	0.61		0.56			0.84	0.67
	9	(229)	1.00	0.81			0.70	0.63		0.66			0.88	0.71
	10	(254)		0.84			0.72	0.64		0.77			0.93	0.75
	11	(279)		0.88			0.74	0.65		0.89			0.98	0.78
	12	(305)		0.91			0.76	0.67		1.00			1.00	0.82
	14	(356)		0.98			0.80	0.70						0.89
	16	(406)		1.00			0.85	0.72						0.95
	18	(457)					0.89	0.75						1.00
	20	(508)					0.93	0.78						
	24	(610)					1.00	0.84						
	30	(762)						0.92						
	> 36	(914)						1.00						

[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 Appendix D.

[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, this indicates that this specific edge distance may not be permitted with a certain spacing (or vice versa). Check with table 5 and figure 2 of this section to calculate permissable edge distance, spacing and concrete thickness combinations.

3.3.6 KWIK HUS-EZ (KH-EZ) Carbon Steel Screw Anchor

Table 16 - Hilti KWIK HUS-EZ in the soffit of uncracked lightweight concrete over metal deck[1,2,3,4,5,6]

Nominal anchor diameter	Nominal embedment in. (mm)	Installation in lower flute				Installation in upper flute			
		Tension - ϕN_n		Shear - ϕV_n		Tension - ϕN_n		Shear - ϕV_n	
		f'_c = 3000 psi lb (kN)	f'_c = 4000 psi lb (kN)	f'_c = 3000 psi lb (kN)	f'_c = 4000 psi lb (kN)	f'_c = 3000 psi lb (kN)	f'_c = 4000 psi lb (kN)	f'_c = 3000 psi lb (kN)	f'_c = 4000 psi lb (kN)
1/4	1-5/8	545	595	725	725	670	730	725	725
	(41)	(2.4)	(2.6)	(3.2)	(3.2)	(3.0)	(3.2)	(3.2)	(3.2)
	2-1/2	1,220	1,410	1,325	1,325	1,275	1,470	1,960	1,960
	(64)	(5.4)	(6.3)	(5.9)	(5.9)	(5.7)	(6.5)	(8.7)	(8.7)
3/8	1-5/8	845	975	905	905	970	1,120	2,200	2,200
	(41)	(3.8)	(4.3)	(4.0)	(4.0)	(4.3)	(5.0)	(9.8)	(9.8)
	2-1/2	1,455	1,680	905	905	1,900	2,195	3,655	3,655
	(64)	(6.5)	(7.5)	(4.0)	(4.0)	(8.5)	(9.8)	(16.3)	(16.3)
	3-1/4	2,550	2,945	2,165	2,165	n/a	n/a	n/a	n/a
	(83)	(11.3)	(13.1)	(9.6)	(9.6)				
1/2	2-1/4	850	980	965	965	905	1,045	4,710	4,710
	(57)	(3.8)	(4.4)	(4.3)	(4.3)	(4.0)	(4.6)	(21.0)	(21.0)
	3	1,990	2,300	1,750	1,750	n/a	n/a	n/a	n/a
	(76)	(8.9)	(10.2)	(7.8)	(7.8)				
	4-1/4	3,485	4,025	2,155	2,155	n/a	n/a	n/a	n/a
	(108)	(15.5)	(17.9)	(9.6)	(9.6)				
5/8	3-1/4	2,715	3,135	2,080	2,080	n/a	n/a	n/a	n/a
	(83)	(12.1)	(13.9)	(9.3)	(9.3)				
	5	6,170	7,125	2,515	2,515	n/a	n/a	n/a	n/a
	(127)	(27.4)	(31.7)	(11.2)	(11.2)				
3/4	4	2,715	3,135	2,255	2,255	n/a	n/a	n/a	n/a
	(102)	(12.1)	(13.9)	(10.0)	(10.0)				

Table 17 - Hilti KWIK HUS-EZ in the soffit of cracked lightweight concrete over metal deck[1,2,3,4,5,6]

Nominal anchor diameter	Nominal embedment in. (mm)	Installation in lower flute				Installation in upper flute			
		Tension - ϕN_n[7]		Shear - ϕV_n[7,8]		Tension - ϕN_n[7]		Shear - ϕV_n[7,8]	
		f'_c = 3000 psi lb (kN)	f'_c = 4000 psi lb (kN)	f'_c = 3000 psi lb (kN)	f'_c = 4000 psi lb (kN)	f'_c = 3000 psi lb (kN)	f'_c = 4000 psi lb (kN)	f'_c = 3000 psi lb (kN)	f'_c = 4000 psi lb (kN)
1/4	1-5/8	280	305	725	725	340	370	725	725
	(41)	(1.2)	(1.4)	(3.2)	(3.2)	(1.5)	(1.6)	(3.2)	(3.2)
	2-1/2	605	700	1,325	1,325	635	735	1,960	1,960
	(64)	(2.7)	(3.1)	(5.9)	(5.9)	(2.8)	(3.3)	(8.7)	(8.7)
3/8	1-5/8	525	605	905	905	770	890	2,200	2,200
	(41)	(2.3)	(2.7)	(4.0)	(4.0)	(3.4)	(4.0)	(9.8)	(9.8)
	2-1/2	1,035	1,195	905	905	1,345	1,555	3,655	3,655
	(64)	(4.6)	(5.3)	(4.0)	(4.0)	(6.0)	(6.9)	(16.3)	(16.3)
	3-1/4	1,805	2,085	2,165	2,165	n/a	n/a	n/a	n/a
	(83)	(8.0)	(9.3)	(9.6)	(9.6)				
1/2	2-1/4	535	620	965	965	640	740	4,710	4,710
	(57)	(2.4)	(2.8)	(4.3)	(4.3)	(2.8)	(3.3)	(21.0)	(21.0)
	3	1,255	1,450	1,750	1,750	n/a	n/a	n/a	n/a
	(76)	(5.6)	(6.4)	(7.8)	(7.8)				
	4-1/4	2,195	2,535	2,155	2,155	n/a	n/a	n/a	n/a
	(108)	(9.8)	(11.3)	(9.6)	(9.6)				
5/8	3-1/4	1,710	1,975	2,080	2,080	n/a	n/a	n/a	n/a
	(83)	(7.6)	(8.8)	(9.3)	(9.3)				
	5	3,885	4,485	2,515	2,515	n/a	n/a	n/a	n/a
	(127)	(17.3)	(20.0)	(11.2)	(11.2)				
3/4	4	1,710	1,975	2,255	2,255	n/a	n/a	n/a	n/a
	(102)	(7.6)	(8.8)	(10.0)	(10.0)				

[1] See section 3.1.7.3 to convert design strength value to ASD value.

[2] Linear interpolation between embedment depths and concrete compressive strengths is not permitted.

[3] Tabular value is for one anchor per flute. Minimum spacing along the length of the flute is 3 x h_{nom} (nominal embedment).

[4] Tabular values are lightweight concrete and no additional reduction factor is needed.

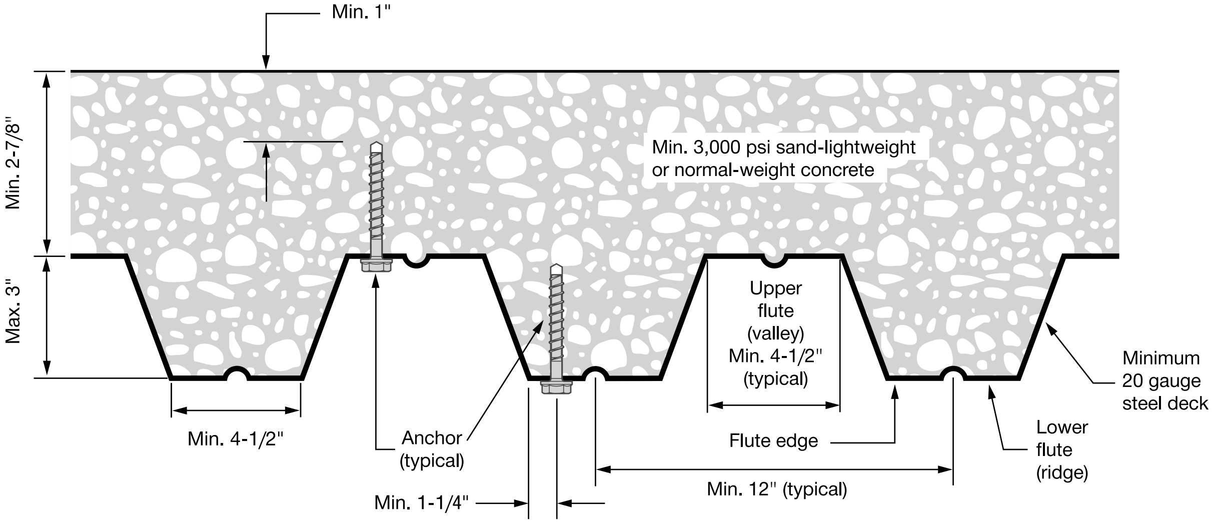
[5] No additional reduction factors for spacing or edge distance need to be applied.

[6] Comparison to steel values in table 4 is not required. Values in tables 16 and 17 control.

[7] Tabular values are for static loads only. For seismic loads, multiply cracked concrete tabular values by α_{seis} = 0.75. See section 3.1.7.4 for additional information on seismic applications.

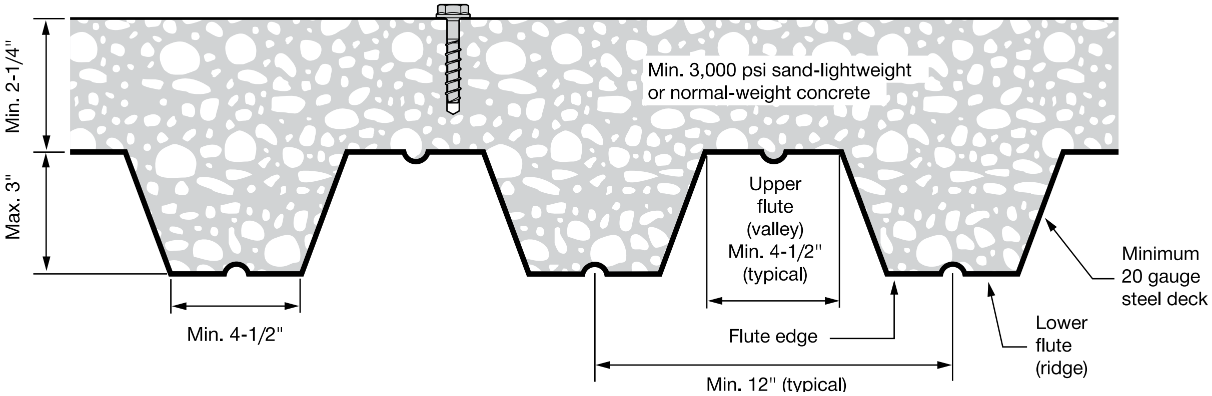
[8] For the following anchor sizes, an additional factor for seismic shear must be applied to the cracked concrete tabular values for seismic conditions:
1/4-inch diameter - $\alpha_{v,seis}$ = 0.75
3/8-inch diameter - $\alpha_{v,seis}$ = 0.60
1/2-inch diameter - $\alpha_{v,seis}$ = 0.60
5/8-inch diameter - $\alpha_{v,seis}$ = 0.60
3/4-inch diameter - $\alpha_{v,seis}$ = 0.70

Figure 3 – Installation of KWIK HUS-EZ (KH-EZ) in soffit of concrete over steel deck floor and roof assemblies[1]



[1] Anchors may be placed in the upper or lower flute of the steel deck profile provided the minimum concrete cover above the drilled hole is satisfied. Anchors in the lower flute may be installed with a maximum 1-inch offset in either direction from the center of the flute. The offset distance may be increased proportionally for profiles with lower flute widths greater than those shown provided the minimum lower flute edge distance is also satisfied.

Figure 4 – Installation of KWIK HUS-EZ on the top of sand-lightweight concrete over metal floor and roof assemblies



3.3.6 KWIK HUS-EZ (KH-EZ) Carbon Steel Screw Anchor

Table 18 - Hilti KWIK HUS-EZ in the top of uncracked concrete over metal deck[1,2,3,4]

Anchor diameter in. (mm)	Nominal embed. depth in. (mm)	Tension - ϕN_n		Shear - ϕV_n	
		f'_c = 3000 psi (20.7 MPa) lb (kN)	f'_c = 4000 psi (27.6 MPa) lb (kN)	f'_c = 3000 psi (20.7 MPa) lb (kN)	f'_c = 4000 psi (27.6 MPa) lb (kN)
1/4 (6.4)	1-5/8 (41)	620 (2.8)	675 (3.0)	1,180 (5.2)	1,360 (6.0)
3/8 (9.5)	1-5/8 (41)	1,000 (4.4)	1,155 (5.1)	1,075 (4.8)	1,245 (5.5)

Table 19 - Hilti KWIK HUS-EZ in the top of ucracked concrete over metal deck[1,2,3,4]

Anchor diameter in. (mm)	Nominal embed. depth in. (mm)	Tension - ϕN_n		Shear - ϕV_n	
		f'_c = 3000 psi (20.7 MPa) lb (kN)	f'_c = 4000 psi (27.6 MPa) lb (kN)	f'_c = 3000 psi (20.7 MPa) lb (kN)	f'_c = 4000 psi (27.6 MPa) lb (kN)
1/4 (6.4)	1-5/8 (41)	315 (1.4)	345 (1.5)	835 (3.7)	965 (4.3)
3/8 (9.5)	1-5/8 (41)	520 (2.3)	600 (2.7)	760 (3.4)	880 (3.9)

1 See section 3.1.7.3 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 20 and 21 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 λa as follows:
for sand-lightweight, λ_a = 0.68; for all-lightweight, λ_a = 0.60

5 Tabular values are for static loads only. For seismic loads, multiply cracked concrete tabular values by the following reduction factors:
1/4-inch diameter - α_{seis} = 0.60
3/8-inch diameter- α_{seis} = 0.75.
See section 3.1.7.4 for additional information on seismic applications.

KWIK HUS-EZ (KH-EZ) Carbon Steel Screw Anchor 3.3.6

Table 20 - Load adjustment factors for KWIK HUS-EZ in the top of uncracked concrete over metal deck[1,2]

1/4-in. and 3/8-in. KH-EZ uncracked concrete over metal deck			Spacing factor in tension f_{AN}		Edge distance factor in tension f_{RN}		Spacing factor in shear[3] f_{AV}		Edge distance in shear				Conc. thickness factor in shear[4] f_{HV}	
									⊥ toward edge f_{RV}		II to edge f_{RV}			
Anchor diameter d_a		in. (mm)	1/4 (6.4)	3/8 (9.5)	1/4 (6.4)	3/8 (9.5)	1/4 (6.4)	3/8 (9.5)	1/4 (6.4)	3/8 (9.5)	1/4 (6.4)	3/8 (9.5)	1/4 (6.4)	3/8 (9.5)
Nominal embed. h_{nom}		in. (mm)	1-5/8 (41)	1-5/8 (41)	1-5/8 (41)	1-5/8 (41)	1-5/8 (41)	1-5/8 (41)	1-5/8 (41)	1-5/8 (41)	1-5/8 (41)	1-5/8 (41)	1-5/8 (41)	1-5/8 (41)
Spacing (s)/edge distance (c_a)/concrete thickness (h) - in. (mm)	1-3/4	(44)	n/a	n/a	0.44	0.58	n/a	n/a	0.44	0.58	0.44	0.58	n/a	n/a
	2	(51)	n/a	n/a	0.50	0.67	n/a	n/a	0.50	0.67	0.50	0.67	n/a	n/a
	2-1/2	(64)	n/a	n/a	0.63	0.83	n/a	n/a	0.63	0.83	0.63	0.83	0.78	0.83
	3	(76)	0.92	0.95	0.75	1.00	0.68	0.71	0.75	1.00	0.75	1.00	0.85	0.91
	3-1/4	(83)	0.96	0.99	0.81		0.70	0.72	0.81		0.81		▨	▨
	3-1/2	(89)	0.99	1.00	0.88		0.71	0.74	0.88		0.88		▨	▨
	4	(102)	1.00		1.00		0.74	0.78	1.00		1.00		▨	▨
	4-1/2	(114)					0.77	0.81					▨	▨
	5	(127)					0.80	0.84					▨	▨
	5-1/2	(140)					0.83	0.88					▨	▨
	6	(152)					0.86	0.91					▨	▨
	6-1/2	(165)					0.89	0.95					▨	▨
	7	(178)					0.92	0.98					▨	▨
	7-1/2	(191)					0.95	1.00					▨	▨
	8	(203)					0.98						▨	▨
	9	(229)					1.00						▨	▨

Table 21 - Load adjustment factors for KWIK HUS-EZ in the top of cracked concrete over metal deck[1,2]

1/4-in. and 3/8-in. KH-EZ uncracked concrete over metal deck			Spacing factor in tension f_{AN}		Edge distance factor in tension f_{RN}		Spacing factor in shear[3] f_{AV}		Edge distance in shear				Conc. thickness factor in shear[4] f_{HV}	
									⊥ toward edge f_{RV}		II to edge f_{RV}			
Anchor diameter d_a		in. (mm)	1/4 (6.4)	3/8 (9.5)	1/4 (6.4)	3/8 (9.5)	1/4 (6.4)	3/8 (9.5)	1/4 (6.4)	3/8 (9.5)	1/4 (6.4)	3/8 (9.5)	1/4 (6.4)	3/8 (9.5)
Nominal embed. h_{nom}		in. (mm)	1-5/8 (41)	1-5/8 (41)	1-5/8 (41)	1-5/8 (41)	1-5/8 (41)	1-5/8 (41)	1-5/8 (41)	1-5/8 (41)	1-5/8 (41)	1-5/8 (41)	1-5/8 (41)	1-5/8 (41)
Spacing (s)/edge distance (c_a)/concrete thickness (h) - in. (mm)	1-3/4	(44)	n/a	n/a	0.99	1.00	n/a	n/a	0.51	0.62	0.99	1.00	n/a	n/a
	2	(51)	n/a	n/a	1.00		n/a	n/a	0.62	0.76	1.00		n/a	n/a
	2-1/2	(64)	n/a	n/a			n/a	n/a	0.87	1.00			0.78	0.83
	3	(76)	0.92	0.95			0.68	0.71	1.00				0.85	0.91
	3-1/4	(83)	0.96	0.99			0.70	0.73					▨	▨
	3-1/2	(89)	0.99	1.00			0.71	0.74					▨	▨
	4	(102)	1.00				0.74	0.78					▨	▨
	4-1/2	(114)					0.77	0.81					▨	▨
	5	(127)					0.80	0.85					▨	▨
	5-1/2	(140)					0.83	0.88					▨	▨
	6	(152)					0.86	0.92					▨	▨
	6-1/2	(165)					0.89	0.95					▨	▨
	7	(178)					0.92	0.98					▨	▨
	7-1/2	(191)					0.95	1.00					▨	▨
	8	(203)					0.98						▨	▨
	9	(229)					1.00						▨	▨

[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 Appendix D.

[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 $f_{HV} = 1.0$.

▨ - For concrete thickness greater than or equal to 3-1/4-inches, the anchor can be designed using either table 2 or table 3 of this section.

3.3.6 KWIK HUS-EZ (KH-EZ) Carbon Steel Screw Anchor

Table 22 – Allowable tension loads for KWIK HUS-EZ installed in grout-filled masonry walls (lb)[1,2,3,4,5]

Nominal anchor diameter	Embedment in.[6]	Loads @ c_{cr} and s_{cr}	Spacing			Edge distance
			Critical - s_{cr} in.[7]	Minimum - S_{min} in.[7]	Load reduction factor at s_{min}[8]	Critical - c_{cr} in.[9]
1/4	1 5/8[10]	530	4	2	0.70	4
	2 1/2[11]	910		4	1.00	
3/8	1 5/8[11]	535	4	2	0.70	4
	2 1/2	895	6	4	0.80	
	3 1/4	1,210				
1/2	2 1/4	710	4	2	0.60	4
	3	1,110	8	4		
	4 1/4	1,515				
5/8	3 1/4	1,155	10	4	0.60	4
	5	1,735				
3/4	4	1,680	12	4	0.60	4
	6 1/4	2,035				

Table 23 – Allowable shear loads for KWIK HUS-EZ installed in grout-filled masonry walls (lb)[1,2,3,4,5]

Nominal anchor diameter	Embedment in.[6]	Load at c_{cr} and s_{cr}	Spacing			Edge distance			
								Load reduction factor at c_{min}	
			Critical - S_{cr} in.[7]	Minimum - S_{min} in.[7]	Load reduction factor at S_{min}[8]	Critical - c_{cr} in.[9]	Minimum - c_{min} in.[9]	Load direction perpendicular to edge	Load direction parallel to edge
1/4	1 5/8	675	4	4	1.00	4	4	1.00	1.00
	2 1/2	840						1.00	1.00
3/8	1 5/8	1,140	6	4	0.94	6	4	0.61	1.00
	2 1/2	1,165						0.70	1.00
	3 1/4	1,190						0.70	1.00
1/2	2 1/4	1,845	8	4	0.88	8	4	0.50	1.00
	3	2,055						0.45	0.94
	4 1/4	2,745						0.40	0.89
5/8	3 1/4	3,040	10	4	0.36	10	4	0.36	0.82
	5	3,485						0.34	0.92
3/4	4	3,040	10	4	0.36	10	4	0.36	0.82
	6 1/4	3,485						0.34	0.92

1 All values are for anchors installed in fully grouted masonry with minimum masonry prism strength of 1,500 psi. Concrete masonry units may be lightweight, medium-weight or normal-weight.

2 Anchors may not be installed within one inch in any direction of a vertical joint.

3 Linear interpolation of load values between minimum spacing s_{min} and critical spacing s_{cr} and between minimum edge distance c_{min} and critical edge distance c_{cr} is permitted.

4 For combined loading: For 1/4-in. - $\frac{T_{applied}}{T_{allowable}} + \frac{V_{applied}}{V_{allowable}} \leq 1$ For 3/8- through 3/4-in. - $\left(\frac{T_{applied}}{T_{allowable}}\right)^{5/3} + \left(\frac{V_{applied}}{V_{allowable}}\right)^{5/3} \leq 1$

5 See figure 5 for anchor locations.

6 Embedment depth is measured from the outside face of the concrete masonry embedment.

7 Critical spacing s_{cr} is the anchor spacing where full load values may be used. The minimum spacing s_{min} is the minimum spacing for which values are available and installation is recommended. Spacing is measured from the center of one anchor to the center of the adjacent anchor.

8 Load reduction factors are multiplicative, both spacing and edge distance load reduction factors must be considered. Load values for anchors installed at less than c_{cr} or s_{cr} must be multiplied by the appropriate load reduction factor based on actual edge distance (c) or spacing (s).

9 The critical edge distance c_{cr} is the edge distance where full load values may be used. The minimum edge distance c_{min} is the minimum edge distance for which values are available and installation is recommended. For tension, c_{cr} equals c_{min}. Edge distance is measured from the center of the anchor to the closest edge.

10 Load values must be reduced by 21% for installations within 1 1/4 inches of the bed joint.

11 Load values must be reduced by 13% for installations within 1 1/4 inches of the bed joint.

KWIK HUS-EZ (KH-EZ) Carbon Steel Screw Anchor 3.3.6

Table 24 – KWIK HUS-EZ allowable loads installed in top of grout-filled concrete masonry walls or horizontal members of wall openings[1,2,3]

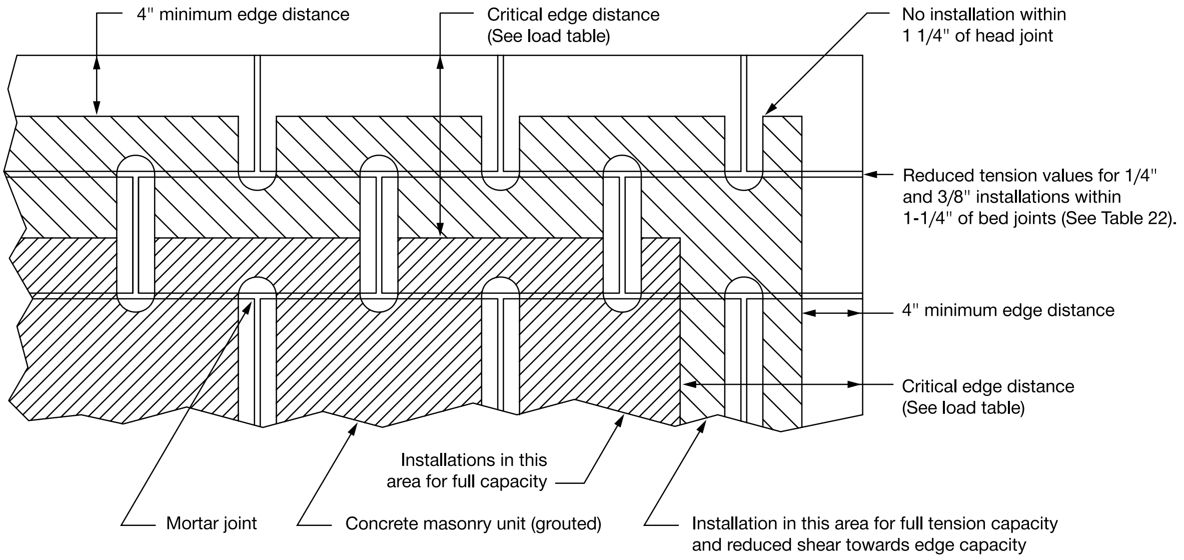
Nominal anchor diameter	Minimum embedment depth in.	Edge distance[4] in.	Critical spacing[5] in.	Minimum end distance[6] in.	Tension lb	Shear lb	
						Load direction	
						Parallel to edge of masonry wall	Perpendicular to edge of masonry wall
1/4	1 5/8	1 1/2	4	4	205	180	135
		3 3/4			205	275	275
	2 1/2	1 1/2			355	345	155
		3 3/4			390	415	330
3/8	1 5/8	1 1/2	6	6	245	345	175
		3 3/4			245	345	435
	3 1/4	1 1/2			465	490	200
		3 3/4			540	800	625
1/2	2 1/4	1 3/4	8	8	390	460	200
		3 3/4			610	525	500
	4 1/4	1 3/4			540	885	245
		3 3/4			750	1275	550
5/8	5	1 3/4	10	10	975	930	245
		3 3/4			975	2190	630
3/4	6 1/4	3 3/4	12	12	975	2430	630

Table 25 – KWIK HUS-EZ allowable loads installed in end of wall or vertical members of wall openings[1,2,3]

Nominal anchor diameter	Minimum embedment depth in.	Edge distance[4] in.	Critical spacing[5] in.	Minimum end distance[6] in.	Tension lb	Shear lb	
						Load direction	
						Parallel to edge of masonry wall	Perpendicular to edge of masonry wall
1/4	1 5/8	1 1/2	4	4	360	525	205
		3 3/4			380	595	585
	2 1/2	1 1/2			590	610	225
		3 3/4			755	635	585
3/8	1 5/8	1 1/2	6	6	355	725	215
		3 3/4			465	1010	825
	3 1/4	1 1/2			565	875	240
		3 3/4			1020	1195	1050
1/2	2 1/4	1 3/4	8	8	500	855	260
		3 3/4			525	1100	1050
	4 1/4	1 3/4			650	925	280
		3 3/4			1150	1240	1050
5/8	5	3 3/4	10	10	1605	2215	1050
3/4	6 1/4	3 3/4	12	12	1865	2550	1050

1 All values are for anchors installed in fully grouted concrete masonry with minimum masonry prism strength of 1,500 psi. Concrete masonry units may be lightweight, medium-weight or normal-weight conforming to ASTM C90. Allowable loads are calculated using safety factor of 5.
2 See figure 6 and 7 for allowable anchor installation locations on the top of grout-filled concrete masonry walls. Anchors may not be installed within one inch of a vertical joint. See figure 7 for anchor installation locations in end-of-wall and vertical members of wall openings.
3 Anchors may not be installed within one inch in any direction of a vertical joint.
4 For load values at edge distances between listed values linear interpolation is permitted.
5 Critical spacing equals minimum spacing.
6 Minimum end distance applicable to top-of-wall and end-of-wall and does not apply for wall openings such as windows.

3.3.6 KWIK HUS-EZ (KH-EZ) Carbon Steel Screw Anchor



Anchor installation is restricted to non-shaded areas

Figure 5 – Acceptable locations (shaded areas) for Hilti KWIK HUS-EZ anchors in grout-filled concrete masonry

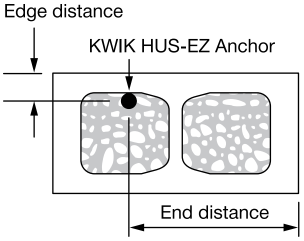


Figure 6 – Edge and end distances for the KWIK HUS-EZ anchor installed in the top of CMU masonry wall construction

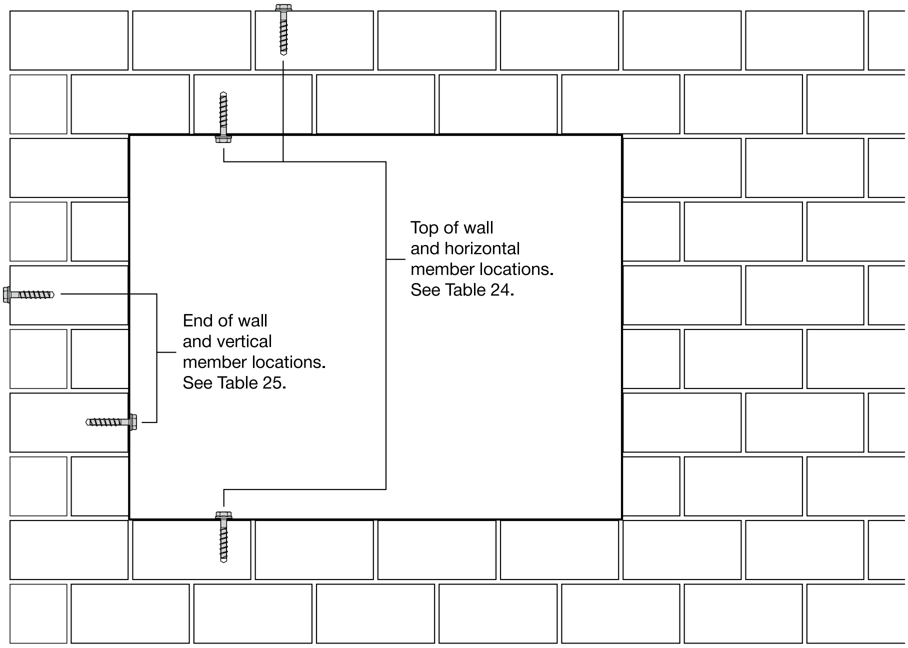


Figure 7 – Anchor locations in end of wall or wall opening applications

3.3.6.4 Installation instructions

Installation Instructions For Use (IFU) are included with each product package. They can also be viewed or downloaded online at www.us.hilti.com (US) and www.hilti.ca (Canada). 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.

3.3.6.5 Ordering information[1]

Description	Hole Diameter	Total Length without Anchor Head	Minimum Embedment Depth	Qty (pcs) / Box
KH-EZ 1/4x1-7/8	1/4	1-7/8	1-5/8	100
KH-EZ 1/4x2-5/8	1/4	2-5/8	2-1/2	100
KH-EZ 1/4x3	1/4	3	2-1/2	100
KH-EZ 1/4x3-1/2	1/4	3-1/2	2-1/2	100
KH-EZ 1/4x4	1/4	4	2-1/2	100
KH-EZ 3/8x1-7/8	3/8	1-7/8	1-5/8	50
KH-EZ 3/8x2-1/8	3/8	2-1/8	1-5/8	50
KH-EZ 3/8x3	3/8	3	2-1/2	50
KH-EZ 3/8x3-1/2	3/8	3-1/2	2-1/2	50
KH-EZ 3/8x4	3/8	4	3-1/4	50
KH-EZ 3/8x5	3/8	5	3-1/4	30
KH-EZ 1/2x2-1/2	1/2	2-1/2	2-1/4	30
KH-EZ 1/2x3	1/2	3	2-1/4	30
KH-EZ 1/2x3-1/2	1/2	3-1/2	3	25
KH-EZ 1/2x4	1/2	4	3	25
KH-EZ 1/2x4-1/2	1/2	4-1/2	4 1/4	25
KH-EZ 1/2x5	1/2	5	4 1/4	25
KH-EZ 1/2x6	1/2	6	4-1/4	25
KH-EZ 5/8x3-1/2	5/8	3-1/2	3-1/4	15
KH-EZ 5/8x4	5/8	4	3-1/4	15
KH-EZ 5/8x5-1/2	5/8	5-1/2	3-1/4	15
KH-EZ 5/8x6-1/2	5/8	6-1/2	3-1/4	15
KH-EZ 5/8x8	5/8	8	3-1/4	15
KH-EZ 3/4x4-1/2	3/4	4-1/2	4	10
KH-EZ 3/4x5-1/2	3/4	5-1/2	4	10
KH-EZ 3/4x7	3/4	7	4	10
KH-EZ 3/4x8	3/4	8	4	10
KH-EZ 3/4x9	3/4	9	4	10

1 All dimensions in inches

WM TAO
& ASSOCIATES
CONSULTING ENGINEERS

Shop Drawing Submittal Review

Transmitted To: Cannon Design

Date: August 26, 2016

Contact Person / WTA Field Inspector: Patrick Garner

Attention: **stl-cac@cannondesign.com**

Project Name: Webster University-**ISB**

Reviewed by: Mark Schaefer

Project No. WT 14127.01

☐ UPS ☐ Courier ☒ **Email**

Copies	No.	Description
1 PDF	238800M03	(Submittal No.'s) ~~(R&B CxSRC)~~
		(Cannon #238800-006) - (Paric #15051-0194) – ~~(WES #607)~~
		• **Ductwork Hangers and Supports**

Remarks:

c: **Kelvin Patel**
Kpatel@cannondesign.com

☒ **Furnish as Submitted**
☐ Furnish as Noted
☐ Rejected
☐ Revise & Resubmit
☐ Reviewed
☐

Corrections or comments made on shop drawings during this review do not relieve contractor from compliance with requirements of drawings and specifications. This check is only for review of general conformance with the design concept of project and general compliance with information given in contract documents. Contractor is responsible for: confirming and correlating all quantities and dimensions; selecting fabrication processes and techniques of construction; coordinating his work with that of all other trades; and performing his work in a safe and satisfactory manner.

If enclosures are not as noted, please notify us at once.
Sara Trout (314) 884-7645

WTASHOP - Webster ISB - 23 8800-006

From: STL-CAC <STL-CAC@CANNONDESIGN.COM>
To: 'Patrick Garner' <pgarner@wmtao.com>, WTASHOP <wtashop@wmtao.com>
Date: 8/19/2016 1:06 PM
Subject: Webster ISB - 23 8800-006
Cc: "Patel, Kelvin" <kpatel@CANNONDESIGN.COM>
Attachments: 238800-006 Ductwork Hangers and Supports.pdf

Attached for review.

Melissa Pirtle
Construction Admin
CANNONDESIGN
1100 Clark Ave
St. Louis, Missouri 63102
T 314.425.8797 • M
cannondesign.com

CANNONDESIGN

SUBMITTAL IDENTIFICATION SHEET

To be completed by Contractor/CM

WEBSTER UNIVERSITY ISB
PROJECT NAME

8274 BIG BEND BLVD
ADDRESS

NUMBER

WEBSTER UNIVERSITY
OWNER

CANNON DESIGN
ARCHITECT / ENGINEER

Joe Voypick
SUBMITTED BY

238800-006
CONTRACTOR / CM SUBMITTAL NO.

CANNON DESIGN SUBMITTAL NO.

DRAWING / DETAIL REFERENCE

238800
SPECIFICATION SECTION / PARAGRAPH

Icon Mechanical
MANUFACTURER / SUPPLIER

ITEM / PRODUCT ID

REQUIRED DATE

PRIORITY

○ CRITICAL

ITEM BEING SUBMITTED (check only one)

○ Shop Drawings
○ Samples
(______ copies)
○ LEED Submittal
○ Certification / Qualifications
○ Record Documents
● Product Data
○ Coordination Drawing
○ Calculations
○ Schedules
○ O&M Manuals
○ Other ____________________

ITEM BEING SUBMITTED FOR (check only one)

● Action ○ Information Only ○ Record

REMARKS OR DEVIATIONS

CONTRACTOR / CM CERTIFICATION
(SUBMITTALS NOT CERTIFIED WILL BE RETURNED WITHOUT REVIEW)

PARIC
EXPERIENCE. EXCELLENCE.

PARIC CORPORATION
SUBMITTAL STAMP

THIS SHOP DRAWING HAS BEEN REVIEWED BY PARIC CORPORATION

Subcontractor remains responsible for dimensions, quantities, coordination with other trades and compliance with contract documents.

By:
Devin D. Gates

Joe Voypick
REVIEWED BY

8/19/16
DATE

To be completed by Reviewer

23 8800-006
CANNON DESIGN SUBMITTAL NUMBER

8/19/16
RECEIVED DATE

○ A. No Exceptions Taken
No further review of submittal is required.

○ B. Make Corrections Noted
Incorporate corrections in work;
resubmission is not required.

○ C. Revise and Resubmit
Revise as noted, and resubmit for review.

○ D. Rejected
Submittal is not in compliance with Contract Documents;
provide new submittal.

○ E. For Record / Information Only
Submittal was reviewed for Record / Information
purposes only.

○ F. Not Required for Review
Submittal is not required by Contract Documents
and has not been reviewed.

Review is for conformance with the design concept of this project and for general compliance with contract documents. Contractor is responsible for quantities, dimensions and compliance with contract documents and for information that pertains to fabrication processes, construction techniques and coordination of this work with all trades which will be affected thereby. This review is null and void if submittal deviates from contract documents and does not indicate or note deviations.

A/E COMMENTS ○ See attached sheet(s) for additional comments

REVIEWED BY

DATE

77 Westport Plaza
Suite 250
St. Louis, MO 63146

Paric Corporation

TRANSMITTAL

No. **15051-0194**

PROJECT: 15051-Webster University Interdisciplinary Science Building

DATE: 08/18/2016

TO: Cannon Design
1100 Clark Ave
St Louis MO 63102

RE: Ductwork Hangers and Supports

ATTN: Kelvin Patel

JOB: **15051**

WE ARE SENDING:	SUBMITTED FOR:	ACTION TAKEN:
☐ Shop Drawings	☑ Approval	☐ Approved as Submitted
☐ Letter	☐ Your Use	☐ Approved as Noted
☐ Prints	☐ As Requested	☐ Returned After Loan
☐ Change Order	☐ Review and Comment	☐ Resubmit
☐ Plans		☐ Submit
☐ Samples	**SENT VIA:**	☐ Returned
☐ Specifications	☐ Attached	☐ Returned for Corrections
☑ Other: Product Data	☐ Separate Cover Via:	☐ Due Date:

Item	*Package*	*Code*	*Rev.*	*Copies*	*Date*	*Description*	*Status*
Submittal		238800-006		1	08/18/2016	Ductwork Hangers and Supports	Submitted

NOTES:

CC:

Signed: ____________________

Devin Gates

icon Mechanical

LETTER OF TRANSMITTAL

TO: Paric Corporation
77 West Port Plaza #250
St. Louis, MO 63146

ATTN: Jason Szachnieski, Devin Gates

DATE: 8/17/16
JOB # : 5768
RE: Webster ISB

We are sending you
____ Attached
____ Under separate cover
X Shop drawings
____ Prints
____ Plans
____ Samples
____ Specifications
____ Copy of letter
____ Change order
____ Other

COPIES	DATE	NO.	DESCRIPTION
1	8/17/16	238800-2.5	Ductwork Hangers and Supports

These are transmitted as checked below:

____ For signature
____ For your use
____ As requested
____ For bids due
X For review and comment
____ Approved as submitted
____ Approved as noted
____ Returned for corrections
____ Prints returned after loan to us
____ Other
____ Resubmit
X Submit
____ Return
____ copies for approval
____ copies for distribution
____ corrected prints

Remarks: Please return by 8/24/16
Gripple Pending AHJ Approval. Verbal Approval given. Waiting on Formal Approval Document. Will Forward to Design Team Once in Hand.

COPY TO: file

SIGNED: Alex Chambers

icon Mechanical

Webster University ISB

Webster Groves, MO

Submittal #: 238800-2.5

Submittal Description: Ductwork Hangers and Supports

Return By: 8/24/16

Please Note: To avoid scheduling delays and equipment release delays, please submit by the "Return By" date.

CHECKED BY:			
DESIGNER:		ENGINEER:	
X	NO EXCEPTION TAKEN		MAKE CORRECTIONS NOTED
	SUBMIT SPECIFIED ITEM		REVISE AND RESUBMIT
	REJECTED		

Checking is only for general conformance with the design concept of the project and general compliance with the information given in the contract documents. Any action shown is subject to the requirements of the plans and specifications. Equipment supplier is responsible for: dimensions which shall be confirmed and correlated at the job site; fabrication processes and techniques of construction; coordination of his work with that of all other trades; and satisfactory performance of his work.

icon Mechanical

Job #:	5768
Date:	8/17/16
By:	ARC