



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

Please refer to the publication in its entirety for complete details on this product including data development, product specifications, general suitability, installation, corrosion and spacing and edge distance guidelines.

US&CA: <https://submittals.us.hilti.com/PTGVol2/>

To consult directly with a team member regarding our anchor fastening products, contact Hilti's team of technical support specialists between the hours of 7:00am – 6:00pm CST.

US: 877-749-6337 or HNATechnicalServices@hilti.com

CA: 1-800-363-4458, ext. 6 or CATechnicalServices@hilti.com

3/8" diameter anchor data for CIP and CMU
is bubbled for convenience

*CIP See Pages 287-291,295-297

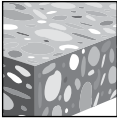
*Grout-filled CMU See Pages 312

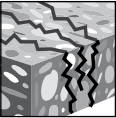
3.3.5 KWIK BOLT TZ EXPANSION ANCHOR

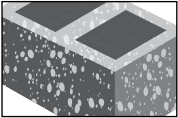
PRODUCT DESCRIPTION

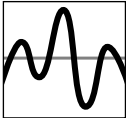
KWIK Bolt TZ carbon steel and stainless steel anchors

Anchor System		Features and Benefits
		• Used with Hilti Dust Removal System (DRS) for dustless drilling and installation (compliant with Table 1 of OSHA 1926.1153 regulations for silica dust exposure). • Accurate SafeSet™ installation when using the Hilti SIW-6AT-A22 impact wrench and the SI-AT-A22 Adaptive Torque Module • Product and length identification marks facilitate quality control after installation. • Through fixture installation and variable thread lengths improve productivity and accommodate various base plate thicknesses. • Type 316 stainless steel wedges provide superior performance in cracked concrete. • Ridges on expansion wedges provide increased reliability. • Mechanical expansion allows immediate load application. • Raised impact section (dog point) prevents thread damage during installation. • Bolt meets ductility requirements of ACI 318-14 Section 2.3. • ACI 349-01 Nuclear Design Guide is available. Call Hilti Technical Support.
Carbon Steel KB-TZ	Stainless Steel KB-TZ	
		
Hilti SIW-6AT-A22 impact wrench and the SI-AT-A22 Adaptive Torque Module		


Uncracked concrete

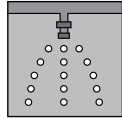

Cracked concrete

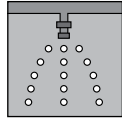

Grout-filled concrete masonry


Seismic Design Categories A-F


SAFESET


Hollow Drill Bit with Adaptive Torque Tool (AT)


Profis Anchor design software


Fire sprinkler listings

Approvals/Listings	
ICC-ES (International Code Council) - 2018 International Building Code / International Residential Code (IBC/IRC) - 2015 National Building Code of Canada (NBC-C)	ESR-1917 in concrete per ACI 318-14 Ch. 17 / ACI 355.2/ ICC-ES AC193 ESR-3785 in grout-filled CMU per ICC-ES AC01 ELC-1917 in concrete per CSA A23.3-14 / ACI 355.2
City of Los Angeles	2017 LABC Supplement (within ESR-1917) RR 26057 grout-filled CMU
Florida Building Code	2010 FBC with HVHZ
FM (Factory Mutual)	Pipe hanger components for automatic sprinkler systems 3/8 through 3/4
UL and cUL (Underwriters Laboratory)	Pipe hanger equipment for fire protection services for 3/8 through 3/4

MATERIAL SPECIFICATIONS

Carbon steel with electroplated zinc

Carbon steel KB-TZ anchors have the following minimum bolt fracture loads.¹

Anchor diameter (in.)	Shear (lb)	Tension (lb)
3/8	NA	6,744
1/2	7,419	11,240
5/8	11,465	17,535
3/4	17,535	25,853

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 sleeves (wedges) are manufactured from type 316 stainless steel

Stainless steel

Stainless steel KB-TZ anchors are made of type 304 or 316 material and have the following minimum bolt fracture loads.¹

Anchor diameter (in.)	Shear (lb)	Tension (lb)
3/8	5,058	6,519
1/2	8,543	12,364
5/8	13,938	19,109
3/4	22,481	24,729

All nuts and washers for type 304 anchors are made from type 304 stainless.

All nuts and washers for type 316 anchors are made from type 316 stainless.

Nuts meet the dimensional requirements of ASTM F594.

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

Expansion sleeve (wedges) are made from type 316 stainless steel.

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 purposes. See tables 4 and 16 for the steel design strengths of carbon steel and stainless steel, respectively.

INSTALLATION PARAMETERS

Figure 1 - Hilti KWIK Bolt TZ specifications

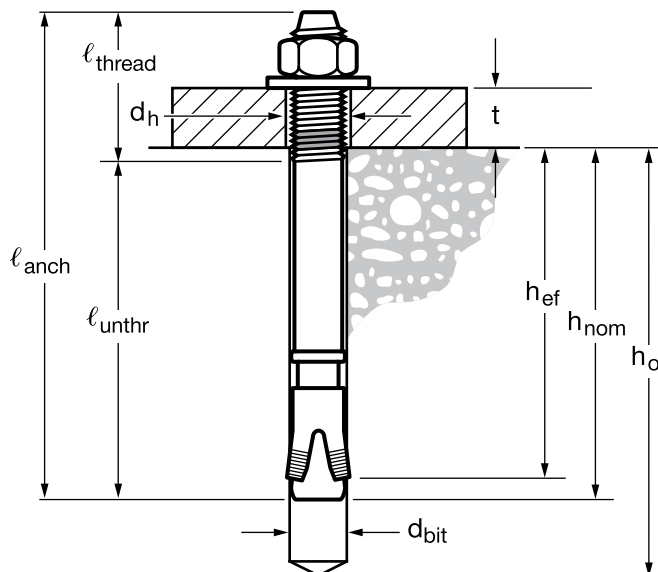


Table 1 - Hilti KWIK Bolt TZ carbon steel specifications

Setting information	Symbol	Units	Nominal anchor diameter d _a														
			3/8			1/2		5/8			3/4						
Nominal bit diameter	d _{bit}	in.	3/8			1/2		5/8			3/4						
Minimum nominal embedment	h _{nom}	in. (mm)	1-13/16 (46)	2-5/16 (59)	3-1/16 (78)	2-3/8 (60)	3-5/8 (91)	3-9/16 (91)	4-7/16 (113)	3-13/16 (97)	4-5/16 (110)	5-5/16 (135)					
Effective minimum embedment	h _{ef}	in. (mm)	1-1/2 (38)	2 (51)	2-3/4 (70)	2 (51)	3-1/4 (83)	3-1/8 (79)	4 (102)	3-1/4 (83)	3-3/4 (95)	4-3/4 (121)					
Min. hole depth	h _o	in. (mm)	2 (51)	2-5/8 (67)	3-3/8 (83)	2-5/8 (67)	4 (102)	3-3/4 (95)	4-3/4 (121)	4 (102)	4-5/8 (117)	5-3/4 (146)					
Min. thickness of fixture ¹	t _{min}	in. (mm)	0 (0)	0 (0)	0 (0)	3/4 (19)	1/4 (6)	3/8 (9)	3/4 (19)	0 (0)	0 (0)	7/8 (23)					
Max. thickness of fixture	t _{max}	in. (mm)	2-13/16 (71)	2-5/16 (59)	1-9/16 (40)	4 (101)	2-3/4 (70)	5-5/8 (143)	4-3/4 (121)	5-9/16 (141)	4-15/16 (125)	3-15/16 (100)					
Installation torque (concrete)	T _{inst}	ft·lb (Nm)	25 (34)			40 (54)		60 (81)			110 (149)						
Installation torque (masonry)	T _{inst}	ft·lb (Nm)	n/a	15 (20)	n/a	25 (34)		35 (47)			n/a	70 (95)					
Fixture hole diameter	d _h	in. (mm)	7/16 (11.1)			9/16 (14.3)		11/16 (17.5)			13/16 (20.6)						
Available anchor lengths	ℓ _{anch}	in. (mm)	3 (76)	3-3/4 (95)	5 (127)	3-3/4 (95)	4-1/2 (114)	5-1/2 (140)	7 (178)	4-3/4 (121)	6 (152)	8-1/2 (216)	10 (254)	5-1/2 (140)	7 (178)	8 (203)	10 (254)
Threaded length including dog point	ℓ _{thread}	in. (mm)	1-1/2 (38)	2-1/4 (57)	3-1/2 (89)	1-5/8 (41)	2-3/8 (60)	3-3/8 (86)	4-7/8 (124)	1-1/2 (38)	2-3/4 (70)	5-1/4 (133)	6-3/4 (171)	2-1/2 (63)	4 (103)	5 (128)	7 (179)
Unthreaded length	ℓ _{unthr}	in. (mm)	1-1/2 (39)			2-1/8 (54)		3-1/4 (83)			3 (77)						

1 Minimum thickness of fixture is a concern only when the anchor is installed at the minimum nominal embedment. When KWIK Bolt TZ anchors are installed at this embedment, the anchor threading ends near the surface of the concrete. If the fixture is sufficiently thin, it could be possible to run the nut to the bottom of the threading during application of the installation torque. If fixtures are thin, it is recommended that embedment be increased accordingly.

Table 2 - Hilti KWIK Bolt TZ stainless steel specifications¹

Setting information	Symbol	Units	Nominal anchor diameter (in.)													
			3/8			1/2			5/8			3/4				
Nominal bit diameter	d _{bit}	in.	3/8			1/2			5/8			3/4				
Nominal min. embedment	h _{nom}	in. (mm)	2-5/16 (59)			2-3/8 (60)	3-5/8 (91)		3-9/16 (91)		4-7/16 (113)		4-5/16 (110)	5-5/16 (142)		
Effective min. embedment	h _{ef}	in. (mm)	2 (51)			2 (51)	3-1/4 (83)		3-1/8 (79)		4 (102)		3-3/4 (95)	4-3/4 (121)		
Min. hole depth	h _o	in. (mm)	2-5/8 (67)			2-5/8 (67)	4 (102)		3-3/4 (95)		4-3/4 (121)		4-5/8 (117)	5-3/4 (146)		
Min. thickness of fixture ¹	t _{min}	in. (mm)	1/4 (6)			3/4 (19)	1/4 (6)		3/8 (9)		3/4 (19)		1/8 (3)	1-5/8 (41)		
Max. thickness of fixture	t _{max}	in. (mm)	2-1/4 (57)			4 (101)	2-3/4 (70)		5-5/8 (143)		4-3/4 (121)		4-5/8 (117)	3-5/8 (92)		
Installation torque (concrete)	T _{inst}	ft-lb (Nm)	25 (34)			40 (54)			60 (81)			110 (149)				
Installation torque (masonry)	T _{inst}	ft-lb (Nm)	15 (20)			25 (34)			35 (47)			70 (95)				
Fixture hole diameter	d _h	in. (mm)	7/16 (11.1)			9/16 (14.3)			11/16 (17.5)			13/16 (20.6)				
Available anchor lengths	l _{anch}	in. (mm)	3 (76)	3-3/4 (95)	5 (127)	3-3/4 (95)	4-1/2 (114)	5-1/2 (140)	7 (178)	4-3/4 (121)	6 (152)	8.5 (216)	10 (254)	5-1/2 (140)	8 (203)	10 (254)
Threaded length including dog point	l _{thread}	in. (mm)	7/8 (22)	1-5/8 (41)	2-7/8 (73)	1-5/8 (41)	2-3/8 (60)	3-3/8 (86)	4-7/8 (124)	1-1/2 (38)	2-3/4 (70)	5-1/4 (133)	6-3/4 (171)	1-1/2 (38)	4 (102)	6 (152)
Unthreaded length	l _{unthr}	in. (mm)	2-1/8 (54)			2-1/8 (54)			3-1/4 (83)			4 (102)				

1 Refer to figure 1 of this section for diagram of installation parameters

2 Minimum thickness of fixture is a concern only when the anchor is installed at the minimum nominal embedment. When KWIK Bolt TZ anchors are installed at this embedment, the anchor threading ends near the surface of the concrete. If the fixture is sufficiently thin, it could be possible to run the nut to the bottom of the threading during application of the installation torque. If fixtures are thin, it is recommended that embedment be increased accordingly.

DESIGN DATA IN CONCRETE PER ACI 318

ACI 318-14 Chapter 17 design

The load values contained in this section are Hilti Simplified Design Tables. The load tables in this section were developed using the Strength Design parameters and variables of ESR-1917 and the equations within ACI 318-14 Chapter 17. For a detailed explanation of the Hilti Simplified Design Tables, refer to section 3.1.8. Data tables from ESR-1917 are not contained in this section, but can be found at www.icc-es.org or at www.hilti.com.

Table 3 - Hilti KWIK Bolt TZ carbon steel design strength with concrete / pullout failure in uncracked concrete^{1,2,3,4,5}

Nominal anchor diameter in.	Effective embed. in. (mm)	Nominal embed. in. (mm)	Tension - ϕN_n				Shear - ϕV_n			
			$f'_c = 2,500$ psi lb (kN)	$f'_c = 3,000$ psi lb (kN)	$f'_c = 4,000$ psi lb (kN)	$f'_c = 6,000$ psi lb (kN)	$f'_c = 2,500$ psi lb (kN)	$f'_c = 3,000$ psi lb (kN)	$f'_c = 4,000$ psi lb (kN)	$f'_c = 6,000$ psi lb (kN)
3/8	1-1/2 (38)	1-13/16 (46)	1,185 (5.3)	1,300 (5.8)	1,500 (6.7)	1,835 (8.2)	1,545 (6.9)	1,690 (7.5)	1,950 (8.7)	2,390 (10.6)
	2 (51)	2-5/16 (59)	1,635 (7.3)	1,790 (8.0)	2,070 (9.2)	2,535 (11.3)	2,375 (10.6)	2,605 (11.6)	3,005 (13.4)	3,680 (16.4)
	2-3/4 (70)	3-1/16 (78)	2,670 (11.9)	2,925 (13.0)	3,380 (15.0)	4,140 (18.4)	7,660 (34.1)	8,395 (37.3)	9,690 (43.1)	11,870 (52.8)
1/2	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)
	3-1/4 (83)	3-5/8 (91)	3,585 (15.9)	3,925 (17.5)	4,535 (20.2)	5,555 (24.7)	9,845 (43.8)	10,785 (48.0)	12,450 (55.4)	15,250 (67.8)
5/8	3-1/8 (79)	3-9/16 (91)	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)	4-7/16 (113)	5,945 (26.4)	6,510 (29.0)	7,520 (33.5)	9,210 (41.0)	13,440 (59.8)	14,725 (65.5)	17,000 (75.6)	20,820 (92.6)
3/4	3-1/4 (83)	3-13/16 (97)	4,570 (20.3)	5,005 (22.3)	5,780 (25.7)	7,080 (31.5)	9,845 (43.8)	10,785 (48.0)	12,450 (55.4)	15,250 (67.8)
	3-3/4 (95)	4-5/16 (110)	5,380 (23.9)	5,895 (26.2)	6,810 (30.3)	8,340 (37.1)	12,200 (54.3)	13,365 (59.5)	15,430 (68.6)	18,900 (84.1)
	4-3/4 (121)	5-9/16 (142)	6,940 (30.9)	7,605 (33.8)	8,780 (39.1)	10,755 (47.8)	17,390 (77.4)	19,050 (84.7)	22,000 (97.9)	26,945 (119.9)

3.3.5

Table 4 - Hilti KWIK Bolt TZ carbon steel design strength with concrete / pullout failure in cracked concrete^{1,2,3,4,5}

Nominal anchor diameter in.	Effective embed. in. (mm)	Nominal embed. in. (mm)	Tension - ϕN_n				Shear - ϕV_n			
			$f'_c = 2,500$ psi lb (kN)	$f'_c = 3,000$ psi lb (kN)	$f'_c = 4,000$ psi lb (kN)	$f'_c = 6,000$ psi lb (kN)	$f'_c = 2,500$ psi lb (kN)	$f'_c = 3,000$ psi lb (kN)	$f'_c = 4,000$ psi lb (kN)	$f'_c = 6,000$ psi lb (kN)
3/8	1-1/2 (38)	1-13/16 (46)	860 (3.8)	940 (4.2)	1,085 (4.8)	1,330 (5.9)	1,095 (4.9)	1,195 (5.3)	1,385 (6.2)	1,695 (7.5)
	2 (51)	2-3/8 (60)	1,565 (7.0)	1,710 (7.6)	1,975 (8.8)	2,420 (10.8)	1,685 (7.5)	1,845 (8.2)	2,130 (9.5)	2,605 (11.6)
	2-3/4 (70)	3-1/8 (79)	2,050 (9.1)	2,245 (10.0)	2,595 (11.5)	3,175 (14.1)	5,425 (24.1)	5,945 (26.4)	6,865 (30.5)	8,405 (37.4)
1/2	2 (51)	2-3/8 (60)	1,565 (7.0)	1,710 (7.6)	1,975 (8.8)	2,420 (10.8)	1,685 (7.5)	1,845 (8.2)	2,130 (9.5)	2,605 (11.6)
	3-1/4 (83)	3-5/8 (91)	3,195 (14.2)	3,500 (15.6)	4,040 (18.0)	4,950 (22.0)	6,970 (31.0)	7,640 (34.0)	8,820 (39.2)	10,800 (48.0)
5/8	3-1/8 (79)	3-9/16 (91)	3,050 (13.6)	3,345 (14.9)	3,860 (17.2)	4,730 (21.0)	6,575 (29.2)	7,200 (32.0)	8,315 (37.0)	10,185 (45.3)
	4 (102)	4-7/16 (113)	4,420 (19.7)	4,840 (21.5)	5,590 (24.9)	6,845 (30.4)	9,520 (42.3)	10,430 (46.4)	12,040 (53.6)	14,750 (65.6)
3/4	3-1/4 (83)	3-13/16 (97)	3,235 (14.4)	3,545 (15.8)	4,095 (18.2)	5,015 (22.3)	6,970 (31.0)	7,640 (34.0)	8,820 (39.2)	10,800 (48.0)
	3-3/4 (95)	4-5/16 (110)	4,010 (17.8)	4,395 (19.5)	5,075 (22.6)	6,215 (27.6)	8,640 (38.4)	9,465 (42.1)	10,930 (48.6)	13,390 (59.6)
	4-3/4 (121)	5-9/16 (142)	5,720 (25.4)	6,265 (27.9)	7,235 (32.2)	8,860 (39.4)	12,320 (54.8)	13,495 (60.0)	15,585 (69.3)	19,085 (84.9)

1 See section 3.1.8 to convert design strength value to ASD value.

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

3 Apply spacing, edge distance, and concrete thickness factors in tables 7 to 14 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, $\lambda_a = 0.68$; for all-lightweight, $\lambda_a = 0.60$

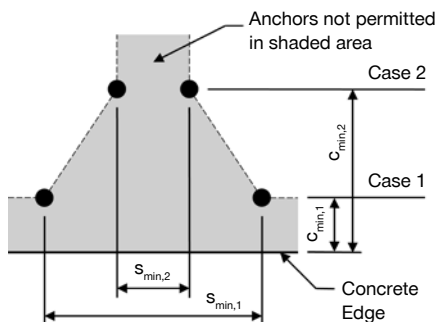
5 Tabular values are for static loads only. Seismic design is not permitted for uncracked concrete. For seismic tension loads, multiply cracked concrete tabular values in tension only by $\alpha_{N,seis} = 0.75$.

No reduction needed for seismic shear. See section 3.1.8 for additional information on seismic applications.

Table 5 - Steel strength for Hilti KWIK Bolt TZ carbon steel anchors^{1,2}

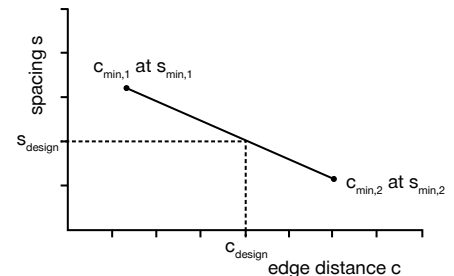
Nominal anchor diameter in	Effective embedment, in. (mm)			Tensile ϕN_{sa} ³ lb (kN)	Shear ϕV_{sa} ⁴ lb (kN)	Seismic shear $\phi V_{sa,eq}$ ⁵ lb (kN)
3/8	1-1/2 (38)			4,875 (21.7)	1,415 (6.3)	1,415 (6.3)
	2 (51)	2-3/4 (70)		4,875 (21.7)	2,335 (10.4)	1,465 (6.5)
1/2	2 (51)	3-1/4 (83)		8,030 (35.7)	3,570 (15.9)	3,570 (15.9)
5/8	3-1/8 (79)		4 (102)	12,880 (57.3)	5,260 (23.4)	4,940 (22.0)
3/4	3-1/4 (83)	3-3/4 (95)	4-3/4 (121)	18,840 (83.8)	8,890 (39.5)	7,635 (34.0)

- 1 See section 3.1.8 to convert design strength value to ASD value.
- 2 Hilti KWIK Bolt TZ 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 318-14 Chapter 17.
- 4 Shear values determined by static shear tests with $\phi V_{sa} < \phi 0.60 A_{se,V} f_{uta}$ as noted in ACI 318-14 Chapter 17.
- 5 Seismic shear values determined by seismic shear tests with $\phi V_{sa,eq} < \phi 0.60 A_{se,V} f_{uta}$ as noted in ACI 318-14 Chapter 17. See section 3.1.8 for additional information on seismic applications.

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 6 - Carbon steel Hilti KWIK Bolt TZ installation parameters¹

Setting information	Symbol	Units	Nominal anchor diameter d _a														
			3/8			1/2				5/8			3/4				
Effective minimum embedment	h _{ef}	in. (mm)	1-1/2 (38)	2 (51)		2-3/4 (70)	2 (51)		3-1/4 (83)		3-1/8 (79)		4 (102)		3-1/4 (83)	3-3/4 (95)	4-3/4 (121)
Min. member thickness	h _{min}	in. (mm)	3-1/4 (83)	4 (102)	5 (127)	5 (127)	4 (102)	6 (152)	6 (152)	8 (203)	5 (127)	6 (152)	8 (203)	5-1/2 (140)	6 (152)	8 (203)	8 (203)
Case 1	c _{min,1}	in. (mm)	8 (203)	2-1/2 (64)		2-1/2 (64)	2-3/4 (70)		2-3/8 (60)		3-5/8 (92)		3-1/4 (83)		9-1/2 (241)	4-3/4 (121)	4-1/8 (105)
	for s _{min,1} ≥	in. (mm)	8 (203)	5 (127)		5 (127)	5-3/4 (146)		5-3/4 (146)		6-1/8 (156)		5-7/8 (149)		5 (127)	10-1/2 (267)	8-7/8 (225)
Case 2	c _{min,2}	in. (mm)	8 (203)	3-5/8 (92)		3-5/8 (92)	4-1/8 (105)		3-1/2 (89)		4-3/4 (121)		4-1/4 (108)		9-1/2 (241)	9-1/2 (241)	7-3/4 (197)
	for s _{min,2} ≥	in. (mm)	8 (203)	2-1/2 (64)		2-1/2 (64)	2-3/4 (70)		2-3/8 (60)		3-1/2 (89)		3 (76)		5 (127)	5 (127)	4 (102)

- 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 7 - Load adjustment factors for 3/8-in. diameter carbon steel Hilti KWIK Bolt TZ in uncracked concrete^{1,2}

3/8-in. KB-TZ CS 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}			To and away from edge f_{RV}					
																	1-1/2 (38)	2 (51)	2-3/4 (70)
Effective embed. h_{ef}	in. (mm)	1-1/2 (38)	2 (51)	2-3/4 (70)	1-1/2 (38)	2 (51)	2-3/4 (70)	1-1/2 (38)	2 (51)	2-3/4 (70)	1-1/2 (38)	2 (51)	2-3/4 (70)	1-1/2 (38)	2 (51)	2-3/4 (70)	1-1/2 (38)	2 (51)	2-3/4 (70)
Nominal embed. h_{nom}	in. (mm)	1-13/16 (46)	2-5/16 (59)	3-1/8 (79)	1-13/16 (46)	2-5/16 (59)	3-1/8 (79)	1-13/16 (46)	2-5/16 (59)	3-1/8 (79)	1-13/16 (46)	2-5/16 (59)	3-1/8 (79)	1-13/16 (46)	2-5/16 (59)	3-1/8 (79)	1-13/16 (46)	2-5/16 (59)	3-1/8 (79)
Spacing (s) / edge distance (c_e) / concrete thickness (h) - in. (mm)	2-1/2 (64)	n/a	0.71	0.65	n/a	0.60	0.71	n/a	0.60	0.55	n/a	0.49	0.16	n/a	0.60	0.32	n/a	n/a	n/a
	3 (76)	n/a	0.75	0.68	n/a	0.69	0.79	n/a	0.62	0.56	n/a	0.64	0.21	n/a	0.69	0.42	n/a	n/a	n/a
	3-1/2 (89)	n/a	0.79	0.71	n/a	0.80	0.88	n/a	0.64	0.57	n/a	0.81	0.27	n/a	0.81	0.53	0.62	n/a	n/a
	3-5/8 (92)	n/a	0.80	0.72	n/a	0.83	0.91	n/a	0.65	0.57	n/a	0.85	0.28	n/a	0.85	0.56	0.63	n/a	n/a
	4 (102)	n/a	0.83	0.74	n/a	0.91	0.98	n/a	0.67	0.58	n/a	0.99	0.33	n/a	0.99	0.65	0.67	0.81	n/a
	4-1/2 (114)	n/a	0.88	0.77	n/a	1.00	1.00	n/a	0.69	0.59	n/a	1.00	0.39	n/a	1.00	0.78	0.71	0.86	n/a
	5 (127)	n/a	0.92	0.80	n/a			n/a	0.71	0.60	n/a		0.46	n/a		0.91	0.75	0.91	0.63
	5-1/2 (140)	n/a	0.96	0.83	n/a			n/a	0.73	0.61	n/a		0.53	n/a		1.00	0.78	0.95	0.66
	6 (152)	n/a	1.00	0.86	n/a			n/a	0.75	0.62	n/a		0.60	n/a			0.82	1.00	0.69
	7 (178)	n/a		0.92	n/a			n/a	0.79	0.64	n/a		0.76	n/a			0.88		0.74
	8 (203)	1.00		0.98	1.00			0.72	0.83	0.66	1.00		0.92	1.00			0.94		0.80
	9 (229)	1.00		1.00				0.75	0.87	0.68			1.00				1.00		0.84
	10 (254)	1.00						0.78	0.91	0.70							1.00		0.89
	11 (279)	1.00						0.81	0.95	0.72									0.93
	12 (305)	1.00						0.83	1.00	0.74									0.97
13 (330)	1.00						0.86	1.00	0.76									1.00	

3.3.5

Table 8 - Load adjustment factors for 3/8-in. diameter carbon steel Hilti KWIK Bolt TZ in cracked concrete^{1,2}

3/8-in. KB-TZ CS 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}			To and away from edge f_{RV}					
Effective embed. h_{ef}	in. (mm)	1-1/2 (38)	2 (51)	2-3/4 (70)	1-1/2 (38)	2 (51)	2-3/4 (70)	1-1/2 (38)	2 (51)	2-3/4 (70)	1-1/2 (38)	2 (51)	2-3/4 (70)	1-1/2 (38)	2 (51)	2-3/4 (70)	1-1/2 (38)	2 (51)	2-3/4 (70)
Nominal embed. h_{nom}	in. (mm)	1-13/16 (46)	2-5/16 (59)	3-1/8 (79)	1-13/16 (46)	2-5/16 (59)	3-1/8 (79)	1-13/16 (46)	2-5/16 (59)	3-1/8 (79)	1-13/16 (46)	2-5/16 (59)	3-1/8 (79)	1-13/16 (46)	2-5/16 (59)	3-1/8 (79)	1-13/16 (46)	2-5/16 (59)	3-1/8 (79)
Spacing (s) / edge distance (c_e) / concrete thickness (h) - in. (mm)	2-1/2 (64)	n/a	0.71	0.65	n/a	0.87	0.71	n/a	0.60	0.55	n/a	0.49	0.16	n/a	0.87	0.33	n/a	n/a	n/a
	3 (76)	n/a	0.75	0.68	n/a	1.00	0.79	n/a	0.62	0.56	n/a	0.65	0.21	n/a	1.00	0.43	n/a	n/a	n/a
	3-1/2 (89)	n/a	0.79	0.71	n/a	1.00	0.88	n/a	0.65	0.57	n/a	0.82	0.27	n/a	1.00	0.54	0.62	n/a	n/a
	3-5/8 (92)	n/a	0.80	0.72	n/a	1.00	0.91	n/a	0.65	0.57	n/a	0.86	0.28	n/a	1.00	0.57	0.63	n/a	n/a
	4 (102)	n/a	0.83	0.74	n/a		0.98	n/a	0.67	0.58	n/a	1.00	0.33	n/a		0.66	0.67	0.82	n/a
	4-1/2 (114)	n/a	0.88	0.77	n/a		1.00	n/a	0.69	0.59	n/a		0.39	n/a		0.79	0.71	0.87	n/a
	5 (127)	n/a	0.92	0.80	n/a			n/a	0.71	0.60	n/a		0.46	n/a		0.92	0.75	0.91	0.63
	5-1/2 (140)	n/a	0.96	0.83	n/a			n/a	0.73	0.61	n/a		0.53	n/a		1.00	0.78	0.96	0.66
	6 (152)	n/a	1.00	0.86	n/a			n/a	0.75	0.62	n/a		0.61	n/a			0.82	1.00	0.69
	7 (178)	n/a		0.92	n/a			n/a	0.79	0.64	n/a		0.76	n/a			0.88		0.75
	8 (203)	1.000		0.98	1.00			0.72	0.83	0.66	1.00		0.93	1.00			0.94		0.80
	9 (229)	1.000		1.00				0.75	0.87	0.68			1.00				1.00		0.85
	10 (254)	1.000						0.78	0.92	0.70									0.89
	11 (279)	1.000						0.81	0.96	0.72									0.94
	12 (305)	1.000						0.83	1.00	0.74									0.98
13 (330)	1.000						0.86		0.76									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 318-14 Chapter 17.

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

■ If a reduction factor value is in a shaded cell, 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 permissible edge distance, spacing and concrete thickness combinations.

Table 9 - Load adjustment factors for 1/2-in. diameter carbon steel Hilti KWIK Bolt TZ in uncracked concrete^{1,2}

1/2-in. KB-TZ CS 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 fac- tor in shear ⁴ f_{HV}	
								$\perp$ toward edge f_{RV}		to and away from edge f_{RV}			
Effective embed. h_{ef}	in. (mm)	2 (51)	3-1/4 (83)	2 (51)	3-1/4 (83)	2 (51)	3-1/4 (83)	2 (51)	3-1/4 (83)	2 (51)	3-1/4 (83)	2 (51)	3-1/4 (83)
Nominal embed. h_{nom}	in. (mm)	2-3/8 (60)	3-5/8 (92)	2-3/8 (60)	3-5/8 (92)	2-3/8 (60)	3-5/8 (92)	2-3/8 (60)	3-5/8 (92)	2-3/8 (60)	3-5/8 (92)	2-3/8 (60)	3-5/8 (92)
Spacing (s) / edge distance (c_s) / concrete thickness (h) - in. (mm)	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
	2-3/4 (70)	0.73	0.64	0.51	0.44	0.62	0.55	0.51	0.16	0.51	0.33	n/a	n/a
	3 (76)	0.75	0.65	0.55	0.46	0.63	0.55	0.55	0.19	0.55	0.37	n/a	n/a
	3-1/2 (89)	0.79	0.68	0.64	0.51	0.65	0.56	0.64	0.23	0.64	0.47	n/a	n/a
	4 (102)	0.83	0.71	0.73	0.56	0.68	0.57	0.73	0.29	0.73	0.56	0.84	n/a
	4-1/8 (105)	0.84	0.71	0.75	0.57	0.68	0.57	0.75	0.30	0.75	0.57	0.85	n/a
	4-1/2 (114)	0.88	0.73	0.82	0.61	0.70	0.58	0.82	0.34	0.82	0.61	0.89	n/a
	5 (127)	0.92	0.76	0.91	0.67	0.72	0.59	0.91	0.40	0.91	0.67	0.94	n/a
	5-1/2 (140)	0.96	0.78	1.00	0.73	0.74	0.60	1.00	0.46	1.00	0.73	0.98	n/a
	5-3/4 (146)	0.98	0.79		0.77	0.75	0.60		0.49		0.77	1.00	n/a
	6 (152)	1.00	0.81		0.80	0.76	0.61		0.53		0.80		0.66
	7 (178)		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						

Table 10 - Load adjustment factors for 1/2-in. diameter carbon steel Hilti KWIK Bolt TZ in cracked concrete^{1,2}

1/2-in. KB-TZ CS 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 fac- tor in shear ⁴ f_{HV}	
								┘ toward edge f_{RV}		┐ to and away from edge f_{RV}			
Effective embed. h_{ef}	in. (mm)	2 (51)	3-1/4 (83)	2 (51)	3-1/4 (83)	2 (51)	3-1/4 (83)	2 (51)	3-1/4 (83)	2 (51)	3-1/4 (83)	2 (51)	3-1/4 (83)
Nominal embed. h_{nom}	in. (mm)	2-3/8 (60)	3-5/8 (92)	2-3/8 (60)	3-5/8 (92)	2-3/8 (60)	3-5/8 (92)	2-3/8 (60)	3-5/8 (92)	2-3/8 (60)	3-5/8 (92)	2-3/8 (60)	3-5/8 (92)
Spacing (s) / edge distance (c_s) / concrete thickness (h) - in. (mm)	2-3/8 (60)	n/a	0.62	n/a	0.63	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	0.65	n/a	0.55	n/a	0.14	n/a	0.29	n/a	n/a
	2-3/4 (70)	0.73	0.64	0.93	0.68	0.62	0.55	0.62	0.16	0.93	0.33	n/a	n/a
	3 (76)	0.75	0.65	1.00	0.71	0.63	0.55	0.71	0.19	1.00	0.38	n/a	n/a
	3-1/2 (89)	0.79	0.68	1.00	0.79	0.65	0.56	0.89	0.24	1.00	0.47	n/a	n/a
	4 (102)	0.83	0.71	1.00	0.86	0.68	0.57	1.00	0.29	1.00	0.58	0.84	n/a
	4-1/8 (105)	0.84	0.71	1.00	0.88	0.68	0.58	1.00	0.30	1.00	0.61	0.85	n/a
	4-1/2 (114)	0.88	0.73		0.94	0.70	0.58		0.34		0.69	0.89	n/a
	5 (127)	0.92	0.76		1.00	0.72	0.59		0.40		0.81	0.94	n/a
	5-1/2 (140)	0.96	0.78			0.74	0.60		0.47		0.93	0.98	n/a
	5-3/4 (146)	0.98	0.79			0.75	0.60		0.50		1.00	1.00	n/a
	6 (152)	1.00	0.81			0.76	0.61		0.53		1.00		0.66
	7 (178)		0.86			0.81	0.63		0.67				0.71
	8 (203)		0.91			0.85	0.65		0.82				0.76
	9 (229)		0.96			0.90	0.66		0.98				0.81
	10 (254)		1.00			0.94	0.68		1.00				0.85
	11 (279)					0.98	0.70						0.90
	12 (305)					1.00	0.72						0.94
	14 (356)						0.76						1.00
	16 (406)						0.79						
	18 (457)						0.83						
	> 20 (508)						0.86						

1 Linear interpolation not permitted.

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

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

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

If a reduction factor value is in a shaded cell, 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 permissible edge distance, spacing and concrete thickness combinations.

Table 11 - Load adjustment factors for 5/8-in. diameter carbon steel Hilti KWIK Bolt TZ in uncracked concrete^{1,2}

5/8-in. KB-TZ CS 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 fac- tor in shear ⁴ f_{HV}	
								⊥ toward edge f_{RV}		to and away from edge f_{RV}			
Effective embed. h_{ef}	in. (mm)	3-1/8 (79)	4 (102)	3-1/8 (79)	4 (102)	3-1/8 (79)	4 (102)	3-1/8 (79)	4 (102)	3-1/8 (79)	4 (102)	3-1/8 (79)	4 (102)
Nominal embed. h_{nom}	in. (mm)	3-9/16 (90)	4-7/16 (113)	3-9/16 (90)	4-7/16 (113)	3-9/16 (90)	4-7/16 (113)	3-9/16 (90)	4-7/16 (113)	3-9/16 (90)	4-7/16 (113)	3-9/16 (90)	4-7/16 (113)
Spacing (s) / edge distance (c_e) / concrete thickness (h) - in. (mm)	3 (76)	n/a	0.63	n/a	n/a	n/a	0.55	n/a	n/a	n/a	n/a	n/a	n/a
	3-1/4 (83)	n/a	0.64	n/a	0.46	n/a	0.55	n/a	0.17	n/a	0.34	n/a	n/a
	3-1/2 (89)	0.69	0.65	n/a	0.48	0.57	0.56	n/a	0.19	n/a	0.38	n/a	n/a
	3-5/8 (92)	0.69	0.65	0.60	0.48	0.57	0.56	0.28	0.20	0.56	0.40	n/a	n/a
	4 (102)	0.71	0.67	0.64	0.51	0.58	0.56	0.32	0.23	0.64	0.47	n/a	n/a
	4-1/4 (108)	0.73	0.68	0.67	0.53	0.58	0.57	0.35	0.26	0.67	0.51	n/a	n/a
	4-1/2 (114)	0.74	0.69	0.70	0.56	0.59	0.57	0.38	0.28	0.70	0.56	n/a	n/a
	4-3/4 (121)	0.75	0.70	0.73	0.58	0.59	0.58	0.42	0.30	0.73	0.58	n/a	n/a
	5 (127)	0.77	0.71	0.77	0.60	0.60	0.58	0.45	0.33	0.77	0.60	0.63	n/a
	5-1/2 (140)	0.79	0.73	0.85	0.64	0.61	0.59	0.52	0.38	0.85	0.64	0.66	n/a
	5-7/8 (149)	0.81	0.74	0.90	0.67	0.62	0.59	0.57	0.42	0.90	0.67	0.68	n/a
	6 (152)	0.82	0.75	0.92	0.69	0.62	0.59	0.59	0.43	0.92	0.69	0.69	0.62
	6-1/8 (156)	0.83	0.76	0.94	0.70	0.62	0.60	0.61	0.44	0.94	0.70	0.69	0.62
	8 (203)	0.93	0.83	1.00	0.91	0.66	0.63	0.91	0.66	1.00	0.91	0.79	0.71
	10 (254)	1.00	0.92		1.00	0.70	0.66	1.00	0.92		1.00	0.89	0.80
	12 (305)		1.00			0.74	0.69		1.00			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						
22 (559)					0.93	0.85							
> 24 (610)					0.97	0.88							

3.3.5

Table 12 - Load adjustment factors for 5/8-in. diameter carbon steel Hilti KWIK Bolt TZ in cracked concrete^{1,2}

5/8-in. KB-TZ CS 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 fac- tor in shear ⁴ f_{HV}	
								⊥ toward edge f_{RV}		to and away from edge f_{RV}			
Effective embed. h_{ef}	in. (mm)	3-1/8 (79)	4 (102)	3-1/8 (79)	4 (102)	3-1/8 (79)	4 (102)	3-1/8 (79)	4 (102)	3-1/8 (79)	4 (102)	3-1/8 (79)	4 (102)
Nominal embed. h_{nom}	in. (mm)	3-9/16 (90)	4-7/16 (113)	3-9/16 (90)	4-7/16 (113)	3-9/16 (90)	4-7/16 (113)	3-9/16 (90)	4-7/16 (113)	3-9/16 (90)	4-7/16 (113)	3-9/16 (90)	4-7/16 (113)
Spacing (s) / edge distance (c_e) / concrete thickness (h) - in. (mm)	3 (76)	n/a	0.63	n/a	n/a	n/a	0.55	n/a	n/a	n/a	n/a	n/a	n/a
	3-1/4 (83)	n/a	0.64	n/a	0.66	n/a	0.55	n/a	0.17	n/a	0.35	n/a	n/a
	3-1/2 (89)	0.69	0.65	n/a	0.69	0.57	0.56	n/a	0.19	n/a	0.39	n/a	n/a
	3-5/8 (92)	0.69	0.65	0.83	0.71	0.57	0.56	0.28	0.20	0.56	0.41	n/a	n/a
	4 (102)	0.71	0.67	0.89	0.75	0.58	0.56	0.33	0.24	0.65	0.47	n/a	n/a
	4-1/4 (108)	0.73	0.68	0.93	0.78	0.58	0.57	0.36	0.26	0.71	0.52	n/a	n/a
	4-1/2 (114)	0.74	0.69	0.97	0.81	0.59	0.57	0.39	0.28	0.78	0.56	n/a	n/a
	4-3/4 (121)	0.75	0.70	1.00	0.84	0.59	0.58	0.42	0.31	0.84	0.61	n/a	n/a
	5 (127)	0.77	0.71		0.87	0.60	0.58	0.45	0.33	0.91	0.66	0.63	n/a
	5-1/2 (140)	0.79	0.73		0.93	0.61	0.59	0.52	0.38	1.00	0.76	0.66	n/a
	5-7/8 (149)	0.81	0.74		0.98	0.62	0.59	0.58	0.42		0.84	0.68	n/a
	6 (152)	0.82	0.75		1.00	0.62	0.60	0.60	0.43		0.87	0.69	0.62
	6-1/8 (156)	0.83	0.76			0.62	0.60	0.62	0.45		0.89	0.69	0.62
	8 (203)	0.93	0.83			0.66	0.63	0.92	0.67		1.00	0.79	0.71
	10 (254)	1.00	0.92			0.70	0.66	1.00	0.93			0.89	0.80
	12 (305)		1.00			0.74	0.69		1.00			0.97	0.87
	14 (356)					0.78	0.72					1.00	0.94
	16 (406)					0.82	0.75						1.00
	18 (457)					0.85	0.79						
	20 (508)					0.89	0.82						
	22 (559)					0.93	0.85						
	> 24 (610)					0.97	0.88						

1 Linear interpolation not permitted.

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

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

 If a reduction factor value is in a shaded cell, 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 permissible edge distance, spacing and concrete thickness combinations.

Table 13 - Load adjustment factors for 3/4-in. diameter carbon steel Hilti KWIK Bolt TZ in uncracked concrete^{1,2}

3/4-in. KB-TZ CS 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}			to and away from edge f_{RV}						
Effective embed. h_{ef}	in. (mm)	3-1/4 (83)	3-3/4 (95)	4-3/4 (121)	3-1/4 (83)	3-3/4 (95)	4-3/4 (121)	3-1/4 (83)	3-3/4 (95)	4-3/4 (121)	3-1/4 (83)	3-3/4 (95)	4-3/4 (121)	3-1/4 (83)	3-3/4 (95)	4-3/4 (121)	3-1/4 (83)	3-3/4 (95)	4-3/4 (121)	
Nominal embed. h_{nom}	in. (mm)	3-13/16 (97)	4-5/16 (110)	5-9/16 (141)	3-13/16 (97)	4-5/16 (110)	5-9/16 (141)	3-13/16 (97)	4-5/16 (110)	5-9/16 (141)	3-13/16 (97)	4-5/16 (110)	5-9/16 (141)	3-13/16 (97)	4-5/16 (110)	5-9/16 (141)	3-13/16 (97)	4-5/16 (110)	5-9/16 (142)	
Spacing (s) / edge distance (c ₁) / concrete thickness (h) - in. (mm)	4 (102)	n/a	n/a	0.640	n/a	n/a	n/a	n/a	n/a	0.557	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	4-1/8 (105)	n/a	n/a	0.645	n/a	n/a	0.546	n/a	n/a	0.558	n/a	n/a	0.207	n/a	n/a	0.414	n/a	n/a	n/a	n/a
	4-1/2 (114)	n/a	n/a	0.658	n/a	n/a	0.574	n/a	n/a	0.564	n/a	n/a	0.236	n/a	n/a	0.472	n/a	n/a	n/a	n/a
	4-3/4 (121)	n/a	n/a	0.667	n/a	0.495	0.594	n/a	n/a	0.567	n/a	0.348	0.256	n/a	0.495	0.512	n/a	n/a	n/a	n/a
	5 (127)	0.756	0.722	0.675	n/a	0.514	0.613	0.569	0.587	0.571	n/a	0.376	0.276	n/a	0.514	0.552	n/a	n/a	n/a	n/a
	5-1/2 (140)	0.782	0.744	0.693	n/a	0.553	0.653	0.576	0.595	0.578	n/a	0.433	0.319	n/a	0.553	0.637	0.553	n/a	n/a	n/a
	6 (152)	0.808	0.767	0.711	n/a	0.600	0.695	0.583	0.604	0.585	n/a	0.494	0.363	n/a	0.600	0.695	0.577	0.645	n/a	n/a
	7 (178)	0.859	0.811	0.746	n/a	0.700	0.781	0.597	0.621	0.599	n/a	0.622	0.458	n/a	0.700	0.781	0.624	0.697	n/a	n/a
	7-3/4 (197)	0.897	0.844	0.772	n/a	0.775	0.861	0.608	0.634	0.610	n/a	0.725	0.533	n/a	0.775	0.861	0.656	0.733	n/a	n/a
	8 (203)	0.910	0.856	0.781	n/a	0.800	0.889	0.611	0.639	0.613	n/a	0.760	0.559	n/a	0.800	0.889	0.667	0.745	0.673	0.673
	8-7/8 (225)	0.955	0.894	0.811	n/a	0.888	0.986	0.623	0.654	0.625	n/a	0.888	0.653	n/a	0.888	0.986	0.702	0.785	0.708	0.708
	9-1/2 (241)	0.987	0.922	0.833	0.792	0.950	1.000	0.632	0.665	0.634	0.704	0.984	0.723	0.792	0.984	1.000	0.726	0.812	0.733	0.733
	10 (254)	1.000	0.944	0.851	0.833	1.000		0.639	0.674	0.641	0.761	1.000	0.781	0.833	1.000		0.745	0.833	0.752	0.752
	10-1/2 (267)		0.967	0.868	0.875			0.646	0.682	0.648	0.818		0.841	0.875			0.764	0.854	0.771	0.771
	12 (305)		1.000	0.921	1.000			0.667	0.708	0.670	1.000		1.000	1.000			0.816	0.913	0.824	0.824
	14 (356)			0.991				0.694	0.743	0.698							0.882	0.986	0.890	0.890
	16 (406)			1.000				0.722	0.778	0.726							0.943	1.000	0.951	0.951
	18 (457)							0.750	0.812	0.754							1.000		1.000	1.000
	20 (508)							0.778	0.847	0.783										
	22 (559)							0.806	0.882	0.811										
	> 24 (610)							0.833	0.916	0.839										

Table 14 - Load adjustment factors for 3/4-in. diameter carbon steel Hilti KWIK Bolt TZ in cracked concrete^{1,2}

3/4-in. KB-TZ CS 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}			┴ to and away from edge f_{RV}					
Effective embed. h_{ef}	in. (mm)	3-1/4 (83)	3-3/4 (95)	4-3/4 (121)	3-1/4 (83)	3-3/4 (95)	4-3/4 (121)	3-1/4 (83)	3-3/4 (95)	4-3/4 (121)	3-1/4 (83)	3-3/4 (95)	4-3/4 (121)	3-1/4 (83)	3-3/4 (95)	4-3/4 (121)	3-1/4 (83)	3-3/4 (95)	4-3/4 (121)
Nominal embed. h_{nom}	in. (mm)	3-13/16 (97)	4-5/16 (110)	5-9/16 (141)	3-13/16 (97)	4-5/16 (110)	5-9/16 (141)	3-13/16 (97)	4-5/16 (110)	5-9/16 (141)	3-13/16 (97)	4-5/16 (110)	5-9/16 (141)	3-13/16 (97)	4-5/16 (110)	5-9/16 (141)	3-13/16 (97)	4-5/16 (110)	5-9/16 (142)
Spacing (s) / edge distance (c) / concrete thickness (h) - in. (mm)	4 (102)	n/a	n/a	0.640	n/a	n/a	n/a	n/a	n/a	0.557	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	4-1/8 (105)	n/a	n/a	0.645	n/a	n/a	0.690	n/a	n/a	0.559	n/a	n/a	0.209	n/a	n/a	0.417	n/a	n/a	n/a
	4-1/2 (114)	n/a	n/a	0.658	n/a	n/a	0.726	n/a	n/a	0.564	n/a	n/a	0.238	n/a	n/a	0.476	n/a	n/a	n/a
	4-3/4 (121)	n/a	n/a	0.667	n/a	0.879	0.750	n/a	n/a	0.568	n/a	0.351	0.258	n/a	0.701	0.516	n/a	n/a	n/a
	5 (127)	0.756	0.722	0.675	n/a	0.913	0.775	0.599	0.587	0.571	n/a	0.379	0.279	n/a	0.757	0.557	n/a	n/a	n/a
	5-1/2 (140)	0.782	0.744	0.693	n/a	0.982	0.825	0.609	0.596	0.578	n/a	0.437	0.321	n/a	0.874	0.643	0.659	n/a	n/a
	6 (152)	0.808	0.767	0.711	n/a	1.000	0.877	0.619	0.605	0.585	n/a	0.498	0.366	n/a	0.996	0.732	0.689	0.647	n/a
	7 (178)	0.859	0.811	0.746	n/a	1.000	0.986	0.638	0.622	0.600	n/a	0.627	0.461	n/a	1.000	0.923	0.744	0.699	n/a
	7-3/4 (197)	0.897	0.844	0.772	n/a	1.000	1.000	0.653	0.635	0.610	n/a	0.731	0.538	n/a		1.000	0.783	0.735	n/a
	8 (203)	0.910	0.856	0.781	1.000	1.000		0.658	0.640	0.614	0.923	0.767	0.564	1.000			0.795	0.747	0.674
	8-7/8 (225)	0.955	0.894	0.811	1.000	1.000		0.675	0.655	0.626	1.000	0.896	0.659				0.837	0.787	0.710
	9-1/2 (241)	0.987	0.922	0.833	1.000	1.000		0.688	0.666	0.635		0.992	0.729				0.866	0.814	0.735
	10 (254)	1.000	0.944	0.851				0.698	0.674	0.642		1.000	0.788				0.889	0.835	0.754
	10-1/2 (267)		0.967	0.868				0.707	0.683	0.649			0.848				0.911	0.856	0.773
	12 (305)		1.000	0.921				0.737	0.709	0.671			1.000				0.974	0.915	0.826
	14 (356)			0.991				0.777	0.744	0.699							1.000	0.989	0.892
	16 (406)			1.000				0.816	0.779	0.727								1.000	0.954
	18 (457)							0.856	0.814	0.756									1.000
	20 (508)							0.895	0.849	0.784									
	22 (559)							0.935	0.884	0.813									
	> 24 (610)							0.974	0.919	0.841									

1 Linear interpolation not permitted.

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

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

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

If a reduction factor value is in a shaded cell, 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 permissible edge distance, spacing and concrete thickness combinations.

Table 15 - Hilti KWIK Bolt TZ stainless steel design strength with concrete / pullout failure in uncracked concrete^{1,2,3,4,5}

Nominal anchor diameter in.	Effective embed. in. (mm)	Nominal embed. in. (mm)	Tension - ϕN_n				Shear - ϕV_n			
			$f'_c = 2,500$ psi lb (kN)	$f'_c = 3,000$ psi lb (kN)	$f'_c = 4,000$ psi lb (kN)	$f'_c = 6,000$ psi lb (kN)	$f'_c = 2,500$ psi lb (kN)	$f'_c = 3,000$ psi lb (kN)	$f'_c = 4,000$ psi lb (kN)	$f'_c = 6,000$ psi lb (kN)
3/8	2 (51)	2-5/16 (59)	1,710 (7.6)	1,875 (8.3)	2,160 (9.6)	2,650 (11.8)	2,375 (10.6)	2,605 (11.6)	3,005 (13.4)	3,680 (16.4)
	2 (51)	2-3/8 (60)	1,865 (8.3)	2,045 (9.1)	2,360 (10.5)	2,890 (12.9)	2,375 (10.6)	2,605 (11.6)	3,005 (13.4)	3,680 (16.4)
1/2	3-1/4 (83)	3-5/8 (91)	3,745 (16.7)	4,100 (18.2)	4,735 (21.1)	5,800 (25.8)	9,845 (43.8)	10,785 (48.0)	12,450 (55.4)	15,250 (67.8)
	3-1/8 (79)	3-9/16 (91)	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)
5/8	4 (102)	4-7/16 (113)	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)
	3-3/4 (95)	4-5/16 (110)	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)
3/4	4-3/4 (121)	5-9/16 (142)	7,825 (34.8)	8,575 (38.1)	9,900 (44.0)	12,125 (53.9)	17,390 (77.4)	19,050 (84.7)	22,000 (97.9)	26,945 (119.9)

3.3.5

Table 16 - Hilti KWIK Bolt TZ stainless steel design strength with concrete / pullout failure in cracked concrete^{1,2,3,4,5}

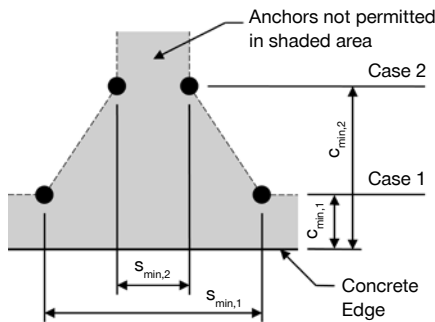
Nominal anchor diameter in.	Effective embed. in. (mm)	Nominal embed. in. (mm)	Tension - ϕN_n				Shear - ϕV_n			
			$f'_c = 2,500$ psi lb (kN)	$f'_c = 3,000$ psi lb (kN)	$f'_c = 4,000$ psi lb (kN)	$f'_c = 6,000$ psi lb (kN)	$f'_c = 2,500$ psi lb (kN)	$f'_c = 3,000$ psi lb (kN)	$f'_c = 4,000$ psi lb (kN)	$f'_c = 6,000$ psi lb (kN)
3/8	2 (51)	2-5/16 (59)	1,520 (6.8)	1,665 (7.4)	1,925 (8.6)	2,355 (10.5)	1,685 (7.5)	1,845 (8.2)	2,130 (9.5)	2,605 (11.6)
	2 (51)	2-3/8 (60)	1,780 (7.8)	1,915 (8.5)	2,210 (9.8)	2,710 (12.1)	2,375 (10.6)	2,605 (11.6)	3,005 (13.4)	3,680 (16.4)
1/2	3-1/4 (83)	3-5/8 (91)	3,235 (14.4)	3,545 (15.8)	4,095 (18.2)	5,015 (22.3)	6,970 (31.0)	7,640 (34.0)	8,820 (39.2)	10,800 (48.0)
	3-1/8 (79)	3-9/16 (91)	3,050 (13.6)	3,345 (14.9)	3,860 (17.2)	4,730 (21.0)	6,575 (29.2)	7,200 (32.0)	8,315 (37.0)	10,185 (45.3)
5/8	4 (102)	4-7/16 (113)	3,795 (16.9)	4,160 (18.5)	4,800 (21.4)	5,880 (26.2)	9,520 (42.3)	10,430 (46.4)	12,040 (53.6)	14,750 (65.6)
	3-3/4 (95)	4-5/16 (110)	5,270 (23.4)	5,775 (25.7)	6,670 (29.7)	8,165 (36.3)	12,200 (54.3)	13,365 (59.5)	15,430 (68.6)	18,900 (84.1)
3/4	4-3/4 (121)	5-9/16 (142)	5,720 (25.4)	6,265 (27.9)	7,235 (32.2)	8,860 (39.4)	12,320 (54.8)	13,495 (60.0)	15,585 (69.3)	19,085 (84.9)

- 1 See section 3.1.8 to convert design strength value to ASD value.
- 2 Linear interpolation between embedment depths and concrete compressive strengths is not permitted.
- 3 Apply spacing, edge distance, and concrete thickness factors in tables 19 to 26 as necessary. Compare to the steel values in table 17. 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, $\lambda_a = 0.60$
- 5 Tabular values are for static loads only. Seismic design is not permitted for uncracked concrete. For seismic tension loads, multiply cracked concrete tabular values in tension by the following reduction factors:
1/2-in diameter by 2-in effective embedment depth - $\alpha_{N,seis} = 0.64$
All other sizes - $\alpha_{N,seis} = 0.75$
No reduction needed for seismic shear. See Section 3.1.8 for additional information on seismic applications.

Table 17 - Steel strength for Hilti KWIK Bolt TZ stainless steel anchors^{1,2}

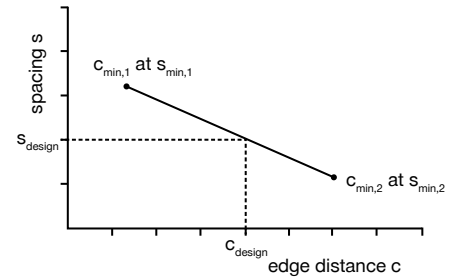
Nominal anchor diameter in.	Tensile ϕN_{sa} ³ lb (kN)	Shear ϕV_{sa} ⁴ lb (kN)	Seismic shear $\phi V_{sa,eq}$ ⁵ lb (kN)
3/8	4,475 (19.9)	3,070 (13.7)	1,835 (8.2)
1/2	8,665 (38.5)	4,470 (19.9)	4,470 (19.9)
5/8	13,410 (59.7)	6,415 (28.5)	6,080 (27.0)
3/4	18,040 (80.2)	10,210 (45.4)	8,380 (37.3)

- 1 See section 3.1.8 to convert design strength value to ASD value.
- 2 Hilti KWIK Bolt TZ 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 318-14 Chapter 17.
- 4 Shear values determined by static shear tests with $\phi V_{sa} < \phi 0.60 A_{se,V} f_{uta}$ as noted in ACI 318-14 Chapter 17.
- 5 Seismic shear values determined by seismic shear tests with $\phi V_{sa,eq} < \phi 0.60 A_{se,V} f_{uta}$ as noted in ACI 318-14 Chapter 17. See section 3.1.8 for additional information on seismic applications.

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 18 - Stainless steel Hilti KWIK Bolt TZ installation parameters¹

Setting information	Symbol	Units	Nominal anchor diameter d _a												
			3/8		1/2				5/8			3/4			
Effective minimum embedment ¹	h _{ef}	in. (mm)	2 (51)		2 (51)		3-1/4 (83)		3-1/8 (79)		4 (102)		3-3/4 (95)		4-3/4 (121)
Min. member thickness	h _{min}	in. (mm)	4 (102)	5 (127)	4 (102)	6 (152)	6 (152)	8 (203)	5 (127)	6 (152)	8 (203)	6 (152)	8 (203)	8 (203)	
Case 1	c _{min,1}	in. (mm)	2-1/2 (64)		2-7/8 (73)		2-1/8 (54)		3-1/4 (83)		2-3/8 (60)		4-1/4 (108)		4 (102)
	for s _{min,1} ≥	in. (mm)	5 (127)		5-3/4 (146)		5-1/4 (133)		5-1/2 (140)		5-1/2 (140)		10 (254)		8-1/2 (216)
Case 2	c _{min,2}	in. (mm)	3-1/2 (89)		4-1/2 (114)		3-1/4 (83)		4-1/8 (105)		4-1/4 (108)		9-1/2 (241)		7 (178)
	for s _{min,2} ≥	in. (mm)	2-1/4 (57)		2-7/8 (73)		2 (51)		2-3/4 (70)		2-3/8 (60)		5 (127)		4 (102)

- 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 19 - Load adjustment factors for 3/8-in. diameter stainless steel Hilti KWIK Bolt TZ in uncracked concrete^{1,2}

3/8-in. KB-TZ SS 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}	to and away from edge f_{RV}	
Effective embed. h_{ef}	in. (mm)	2 (51)	2 (51)	2 (51)	2 (51)	2 (51)
Nominal embed. h_{nom}	in. (mm)	2-5/16 (59)	2-5/16 (59)	2-5/16 (59)	2-5/16 (59)	2-5/16 (59)
Spacing (s) / edge distance (c_e) / concrete thickness (h) - in. (mm)	2-1/4 (57)	0.69	n/a	0.59	n/a	n/a
	2-1/2 (64)	0.71	0.60	0.60	0.49	0.60
	3 (76)	0.75	0.69	0.62	0.64	0.69
	3-1/2 (89)	0.79	0.80	0.64	0.81	0.81
	4 (102)	0.83	0.91	0.67	0.99	0.99
	4-1/2 (114)	0.88	1.00	0.69	1.00	1.00
	5 (127)	0.92		0.71		0.91
	5-1/2 (140)	0.96		0.73		0.95
	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		

3.3.5

Table 20 - Load adjustment factors for 3/8-in. diameter stainless steel Hilti KWIK Bolt TZ in cracked concrete^{1,2}

3/8-in. KB-TZ SS 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}	to and away from edge f_{RV}	
Effective embed. h_{ef}	in. (mm)	2 (51)	2 (51)	2 (51)	2 (51)	2 (51)
Nominal embed. h_{nom}	in. (mm)	2-5/16 (59)	2-5/16 (59)	2-5/16 (59)	2-5/16 (59)	2-5/16 (59)
Spacing (s) / edge distance (c_e) / concrete thickness (h) - in. (mm)	2-1/4 (57)	0.69	n/a	0.59	n/a	n/a
	2-1/2 (64)	0.71	0.87	0.60	0.49	0.87
	3 (76)	0.75	1.00	0.62	0.65	1.00
	3-1/2 (89)	0.79	1.00	0.65	0.82	1.00
	4 (102)	0.83		0.67	1.00	0.82
	4-1/2 (114)	0.88		0.69		0.87
	5 (127)	0.92		0.71		0.91
	5-1/2 (140)	0.96		0.73		0.96
	6 (152)	1.00		0.75		1.00
	7 (178)			0.79		
	8 (203)			0.83		
	9 (229)			0.87		
	10 (254)			0.92		
	11 (279)			0.96		
	12 (305)			1.00		

Linear interpolation not permitted.

- 2 When combining multiple load adjustment factors (e.g. for a 4 anchor pattern in a corner with thin concrete member) the design can become very conservative. To optimize the design, use Hilti PROFIS Anchor Design software or perform anchor calculation using design equations from ACI 318-14 Chapter 17.
- 3 Spacing factor reduction in shear, f_{AV} , assumes an influence of a nearby edge. If no edge exists, then $f_{AV} = f_{AN}$.
- 4 Concrete thickness reduction factor in shear, f_{HV} , assumes an influence of a nearby edge. If no edge exists, then $f_{HV} = 1.0$.

■ If a reduction factor value is in a shaded cell, this indicates that this specific edge distance may not be permitted with a certain spacing (or vice versa). Check with table 17 and figure 3 of this section to calculate permissible edge distance, spacing and concrete thickness combinations.

Table 21 - Load adjustment factors for 1/2-in. diameter stainless steel Hilti KWIK Bolt TZ in uncracked concrete^{1,2}

1/2-in. KB-TZ SS 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 fac- tor in shear ⁴ f_{HV}	
								⊥ toward edge f_{RV}		to and away from edge f_{RV}			
Effective embed. h_{ef}	in. (mm)	2 (51)	3-1/4 (83)	2 (51)	3-1/4 (83)	2 (51)	3-1/4 (83)	2 (51)	3-1/4 (83)	2 (51)	3-1/4 (83)	2 (51)	3-1/4 (83)
Nominal embed. h_{nom}	in. (mm)	2-3/8 (60)	3-5/8 (92)	2-3/8 (60)	3-5/8 (92)	2-3/8 (60)	3-5/8 (92)	2-3/8 (60)	3-5/8 (92)	2-3/8 (60)	3-5/8 (92)	2-3/8 (60)	3-5/8 (92)
Spacing (s) / edge distance (c_e) / concrete thickness (h) - in. (mm)	2 (51)	n/a	0.60	n/a	n/a	n/a	0.54	n/a	n/a	n/a	n/a	n/a	n/a
	2-1/8 (54)	n/a	0.61	n/a	0.39	n/a	0.54	n/a	0.11	n/a	0.22	n/a	n/a
	2-7/8 (73)	0.74	0.65	0.53	0.45	0.63	0.55	0.53	0.17	0.53	0.35	n/a	n/a
	3 (76)	0.75	0.65	0.55	0.46	0.63	0.55	0.55	0.19	0.55	0.37	n/a	n/a
	3-1/4 (83)	0.77	0.67	0.59	0.49	0.64	0.56	0.59	0.21	0.59	0.42	n/a	n/a
	3-1/2 (89)	0.79	0.68	0.64	0.51	0.65	0.56	0.64	0.23	0.64	0.47	n/a	n/a
	4 (102)	0.83	0.71	0.73	0.56	0.68	0.57	0.73	0.29	0.73	0.56	0.84	n/a
	4-1/2 (114)	0.88	0.73	0.82	0.61	0.70	0.58	0.82	0.34	0.82	0.61	0.89	n/a
	5 (127)	0.92	0.76	0.91	0.67	0.72	0.59	0.91	0.40	0.91	0.67	0.94	n/a
	5-1/4 (133)	0.94	0.77	0.95	0.70	0.73	0.60	0.95	0.43	0.95	0.70	0.96	n/a
	5-1/2 (140)	0.96	0.78	1.00	0.73	0.74	0.60	1.00	0.46	1.00	0.73	0.98	n/a
	6 (152)	1.00	0.81		0.80	0.76	0.61		0.53		0.80	1.00	0.66
	7 (178)		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						

Table 22 - Load adjustment factors for 1/2-in. diameter stainless steel Hilti KWIK Bolt TZ in cracked concrete^{1,2}

1/2-in. KB-TZ SS 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 fac- tor in shear ⁴ f_{HV}	
								⊥ toward edge f_{RV}		to and away from edge f_{RV}			
Effective embed. h_{ef}	in. (mm)	2 (51)	3-1/4 (83)	2 (51)	3-1/4 (83)	2 (51)	3-1/4 (83)	2 (51)	3-1/4 (83)	2 (51)	3-1/4 (83)	2 (51)	3-1/4 (83)
Nominal embed. h_{nom}	in. (mm)	2-3/8 (60)	3-5/8 (92)	2-3/8 (60)	3-5/8 (92)	2-3/8 (60)	3-5/8 (92)	2-3/8 (60)	3-5/8 (92)	2-3/8 (60)	3-5/8 (92)	2-3/8 (60)	3-5/8 (92)
Spacing (s) / edge distance (c_e) / concrete thickness (h) - in. (mm)	2 (51)	n/a	0.60	n/a	n/a	n/a	0.54	n/a	n/a	n/a	n/a	n/a	n/a
	2-1/8 (54)	n/a	0.61	n/a	0.60	n/a	0.54	n/a	0.11	n/a	0.22	n/a	n/a
	2-7/8 (73)	0.74	0.65	0.97	0.70	0.60	0.55	0.47	0.18	0.94	0.35	n/a	n/a
	3 (76)	0.75	0.65	1.00	0.71	0.60	0.55	0.50	0.19	1.00	0.38	n/a	n/a
	3-1/4 (83)	0.77	0.67	1.00	0.75	0.61	0.56	0.56	0.21	1.00	0.42	n/a	n/a
	3-1/2 (89)	0.79	0.68	1.00	0.79	0.62	0.56	0.63	0.24	1.00	0.47	n/a	n/a
	4 (102)	0.83	0.71	1.00	0.86	0.64	0.57	0.77	0.29	1.00	0.58	0.75	n/a
	4-1/2 (114)	0.88	0.73	1.00	0.94	0.66	0.58	0.92	0.34	1.00	0.69	0.79	n/a
	5 (127)	0.92	0.76		1.00	0.67	0.59	1.00	0.40		0.81	0.84	n/a
	5-1/4 (133)	0.94	0.77			0.68	0.60		0.43		0.87	0.86	n/a
	5-1/2 (140)	0.96	0.78			0.69	0.60		0.47		0.93	0.88	n/a
	6 (152)	1.00	0.81			0.71	0.61		0.53		1.00	0.92	0.66
	7 (178)		0.86			0.74	0.63		0.67			0.99	0.71
	8 (203)		0.91			0.78	0.65		0.82			1.00	0.76
	9 (229)		0.96			0.81	0.66		0.98				0.81
	10 (254)		1.00			0.85	0.68		1.00				0.85
	11 (279)					0.88	0.70						0.90
	12 (305)					0.92	0.72						0.94
	14 (356)					0.99	0.76						1.00
	16 (406)					1.00	0.79						
	18 (457)						0.83						
	> 20 (508)						0.86						

1 Linear interpolation not permitted.

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

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

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

☐ If a reduction factor value is in a shaded cell, this indicates that this specific edge distance may not be permitted with a certain spacing (or vice versa). Check with table 17 and figure 3 of this section to calculate permissible edge distance, spacing and concrete thickness combinations.

Table 23 - Load adjustment factors for 5/8-in. diameter stainless steel Hilti KWIK Bolt TZ in uncracked concrete^{1,2}

5/8-in. KB-TZ SS 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 fac- tor in shear ⁴ f_{HV}	
								⊥ toward edge f_{RV}		to and away from edge f_{RV}			
Effective embed. h_{ef}	in. (mm)	3-1/8 (79)	4 (102)	3-1/8 (79)	4 (102)	3-1/8 (79)	4 (102)	3-1/8 (79)	4 (102)	3-1/8 (79)	4 (102)	3-1/8 (79)	4 (102)
Nominal embed. h_{nom}	in. (mm)	3-9/16 (90)	4-7/16 (113)	3-9/16 (90)	4-7/16 (113)	3-9/16 (90)	4-7/16 (113)	3-9/16 (90)	4-7/16 (113)	3-9/16 (90)	4-7/16 (113)	3-9/16 (90)	4-7/16 (113)
Spacing (s) / edge distance (c_u) / concrete thickness (h) - in. (mm)	2-3/8 (60)	n/a	0.60	n/a	0.39	n/a	0.54	n/a	0.11	n/a	0.21	n/a	n/a
	2-3/4 (70)	0.65	0.61	n/a	0.41	0.55	0.54	n/a	0.13	n/a	0.27	n/a	n/a
	3 (76)	0.66	0.63	n/a	0.43	0.56	0.55	n/a	0.15	n/a	0.30	n/a	n/a
	3-1/4 (83)	0.67	0.64	0.51	0.45	0.56	0.55	0.24	0.17	0.47	0.34	n/a	n/a
	3-1/2 (89)	0.69	0.65	0.54	0.47	0.57	0.56	0.26	0.19	0.53	0.38	n/a	n/a
	4 (102)	0.71	0.67	0.59	0.51	0.58	0.56	0.32	0.23	0.59	0.47	n/a	n/a
	4-1/2 (114)	0.74	0.69	0.65	0.55	0.59	0.57	0.38	0.28	0.65	0.55	n/a	n/a
	5 (127)	0.77	0.71	0.71	0.59	0.60	0.58	0.45	0.33	0.71	0.59	0.63	n/a
	5-1/2 (140)	0.79	0.73	0.79	0.63	0.61	0.59	0.52	0.38	0.79	0.63	0.66	n/a
	6 (152)	0.82	0.75	0.86	0.68	0.62	0.59	0.59	0.43	0.86	0.68	0.69	0.62
	7 (178)	0.87	0.79	1.00	0.79	0.64	0.61	0.75	0.54	1.00	0.79	0.74	0.67
	8 (203)	0.93	0.83		0.90	0.66	0.63	0.91	0.66		0.90	0.79	0.71
	10 (254)	1.00	0.92		1.00	0.70	0.66	1.00	0.92		1.00	0.89	0.80
	12 (305)		1.00			0.74	0.69		1.00			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						
	22 (559)					0.93	0.85						
	> 24 (610)					0.97	0.88						

3.3.5

Table 24 - Load adjustment factors for 5/8-in. diameter stainless steel Hilti KWIK Bolt TZ in cracked concrete^{1,2}

5/8-in. KB-TZ SS 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 fac- tor in shear ⁴ f_{HV}	
								⊥ toward edge f_{RV}		to and away from edge f_{RV}			
Effective embed. h_{ef}	in. (mm)	3-1/8 (79)	4 (102)	3-1/8 (79)	4 (102)	3-1/8 (79)	4 (102)	3-1/8 (79)	4 (102)	3-1/8 (79)	4 (102)	3-1/8 (79)	4 (102)
Nominal embed. h_{nom}	in. (mm)	3-9/16 (90)	4-7/16 (113)	3-9/16 (90)	4-7/16 (113)	3-9/16 (90)	4-7/16 (113)	3-9/16 (90)	4-7/16 (113)	3-9/16 (90)	4-7/16 (113)	3-9/16 (90)	4-7/16 (113)
Spacing (s) / edge distance (c_u) / concrete thickness (h) - in. (mm)	2-3/8 (60)	n/a	0.60	n/a	0.57	n/a	0.54	n/a	0.11	n/a	0.22	n/a	n/a
	2-3/4 (70)	n/a	0.61	n/a	0.61	n/a	0.54	n/a	0.13	n/a	0.27	n/a	n/a
	3 (76)	0.66	0.63	n/a	0.64	0.56	0.55	n/a	0.15	n/a	0.31	n/a	n/a
	3-1/4 (83)	0.67	0.64	0.77	0.66	0.56	0.55	0.24	0.17	0.48	0.35	n/a	n/a
	3-1/2 (89)	0.69	0.65	0.81	0.69	0.57	0.56	0.27	0.19	0.53	0.39	n/a	n/a
	4 (102)	0.71	0.67	0.89	0.75	0.58	0.56	0.33	0.24	0.65	0.47	n/a	n/a
	4-1/2 (114)	0.74	0.69	0.97	0.81	0.59	0.57	0.39	0.28	0.78	0.56	n/a	n/a
	5 (127)	0.77	0.71	1.00	0.87	0.60	0.58	0.45	0.33	0.91	0.66	0.63	n/a
	5-1/2 (140)	0.79	0.73		0.93	0.61	0.59	0.52	0.38	1.00	0.76	0.66	n/a
	6 (152)	0.82	0.75		1.00	0.62	0.60	0.60	0.43		0.87	0.69	0.62
	7 (178)	0.87	0.79			0.64	0.61	0.75	0.55		1.00	0.74	0.67
	8 (203)	0.93	0.83			0.66	0.63	0.92	0.67			0.79	0.71
	10 (254)	1.00	0.92			0.70	0.66	1.00	0.93			0.89	0.80
	12 (305)		1.00			0.74	0.69		1.00			0.97	0.87
	14 (356)					0.78	0.72					1.00	0.94
	16 (406)					0.82	0.75						1.00
	18 (457)					0.85	0.79						
	20 (508)					0.89	0.82						
	22 (559)					0.93	0.85						
	> 24 (610)					0.97	0.88						

- Linear interpolation not permitted.
 - When combining multiple load adjustment factors (e.g. for a 4 anchor pattern in a corner with thin concrete member) the design can become very conservative. To optimize the design, use Hilti PROFIS Anchor Design software or perform anchor calculation using design equations from ACI 318-14 Chapter 17.
 - Spacing factor reduction in shear, f_{AV} , assumes an influence of a nearby edge. If no edge exists, then $f_{AV} = f_{AN}$.
 - 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 17 and figure 3 of this section to calculate permissible edge distance, spacing and concrete thickness combinations.

Table 25 - Load adjustment factors for 3/4-in. diameter stainless steel Hilti KWIK Bolt TZ in uncracked concrete^{1,2}

3/4-in. KB-TZ CS 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 fac- tor in shear ⁴ f_{HV}	
								$\perp$ toward edge f_{RV}		to and away from edge f_{RV}			
Effective embed. h_{ef}	in. (mm)	3-1/8 (79)	4 (102)	3-1/8 (79)	4 (102)	3-1/8 (79)	4 (102)	3-1/8 (79)	4 (102)	3-1/8 (79)	4 (102)	3-1/8 (79)	4 (102)
Nominal embed. h_{nom}	in. (mm)	4-5/16 (110)	5-9/16 (141)	4-5/16 (110)	5-9/16 (141)	4-5/16 (110)	5-9/16 (141)	4-5/16 (110)	5-9/16 (141)	4-5/16 (110)	5-9/16 (141)	4-5/16 (110)	5-9/16 (142)
Spacing (s) / edge distance (c_e) / concrete thickness (h) - in. (mm)	4 (102)	n/a	0.64	n/a	0.54	n/a	0.56	n/a	0.20	n/a	0.40	n/a	n/a
	4-1/4 (108)	n/a	0.65	0.46	0.56	n/a	0.56	0.29	0.22	0.46	0.43	n/a	n/a
	4-1/2 (114)	n/a	0.66	0.48	0.57	n/a	0.56	0.32	0.24	0.48	0.47	n/a	n/a
	5 (127)	0.72	0.68	0.51	0.61	0.59	0.57	0.38	0.28	0.51	0.55	n/a	n/a
	5-1/2 (140)	0.74	0.69	0.55	0.65	0.60	0.58	0.43	0.32	0.55	0.64	n/a	n/a
	6 (152)	0.77	0.71	0.60	0.69	0.60	0.58	0.49	0.36	0.60	0.69	0.65	n/a
	7 (178)	0.81	0.75	0.70	0.78	0.62	0.60	0.62	0.46	0.70	0.78	0.70	n/a
	8 (203)	0.86	0.78	0.80	0.89	0.64	0.61	0.76	0.56	0.80	0.89	0.75	0.67
	9 (229)	0.90	0.82	0.90	1.00	0.66	0.63	0.91	0.67	0.91	1.00	0.79	0.71
	9-1/2 (241)	0.92	0.83	0.95		0.66	0.63	0.98	0.72	0.98		0.81	0.73
	10 (254)	0.94	0.85	1.00		0.67	0.64	1.00	0.78	1.00		0.83	0.75
	12 (305)	1.00	0.92			0.71	0.67		1.00			0.91	0.82
	14 (356)		0.99			0.74	0.70					0.99	0.89
	16 (406)		1.00			0.78	0.73					1.00	0.95
	18 (457)					0.81	0.75						1.00
	20 (508)					0.85	0.78						
22 (559)					0.88	0.81							
> 24 (610)					0.92	0.84							

Table 26 - Load adjustment factors for 3/4-in. diameter stainless steel Hilti KWIK Bolt TZ in cracked concrete^{1,2}

3/4-in. KB-TZ SS 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 fac- tor in shear ⁴ f_{HV}	
								⊥ toward edge f_{RV}		to and away from edge f_{RV}			
Effective embed. h_{ef}	in. (mm)	3-3/4 (95)	4-3/4 (121)	3-3/4 (95)	4-3/4 (121)	3-3/4 (95)	4-3/4 (121)	3-3/4 (95)	4-3/4 (121)	3-3/4 (95)	4-3/4 (121)	3-3/4 (95)	4-3/4 (121)
Nominal embed. h_{nom}	in. (mm)	4-5/16 (110)	5-9/16 (141)	4-5/16 (110)	5-9/16 (141)	4-5/16 (110)	5-9/16 (141)	4-5/16 (110)	5-9/16 (141)	4-5/16 (110)	5-9/16 (141)	4-5/16 (110)	5-9/16 (142)
Spacing (s) / edge distance (c_e) / concrete thickness (h) - in. (mm)	4 (102)	n/a	0.64	n/a	0.68	n/a	0.56	n/a	0.20	n/a	0.40	n/a	n/a
	4-1/4 (108)	n/a	0.65	0.81	0.70	n/a	0.56	0.21	0.22	0.42	0.44	n/a	n/a
	4-1/2 (114)	n/a	0.66	0.85	0.73	n/a	0.56	0.23	0.24	0.46	0.48	n/a	n/a
	5 (127)	0.72	0.68	0.91	0.77	0.57	0.57	0.27	0.28	0.54	0.56	n/a	n/a
	5-1/2 (140)	0.74	0.69	0.98	0.83	0.58	0.58	0.31	0.32	0.62	0.64	n/a	n/a
	6 (152)	0.77	0.71	1.00	0.88	0.58	0.59	0.35	0.37	0.71	0.73	0.58	n/a
	7 (178)	0.81	0.75	1.00	0.99	0.60	0.60	0.44	0.46	0.89	0.92	0.62	n/a
	8 (203)	0.86	0.78	1.00	1.00	0.61	0.61	0.54	0.56	1.00	1.00	0.67	0.67
	9 (229)	0.90	0.82	1.00		0.62	0.63	0.65	0.67	1.00		0.71	0.72
	9-1/2 (241)	0.92	0.83	1.00		0.63	0.64	0.70	0.73	1.00		0.73	0.74
	10 (254)	0.94	0.85			0.64	0.64	0.76	0.79			0.74	0.75
	12 (305)	1.00	0.92			0.67	0.67	1.00	1.00			0.82	0.83
	14 (356)		0.99			0.69	0.70					0.88	0.89
	16 (406)		1.00			0.72	0.73					0.94	0.95
	18 (457)					0.75	0.76					1.00	1.00
	20 (508)					0.78	0.78						
	22 (559)					0.81	0.81						
	> 24 (610)					0.83	0.84						

1 Linear interpolation not permitted.

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

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

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

If a reduction factor value is in a shaded cell, this indicates that this specific edge distance may not be permitted with a certain spacing (or vice versa). Check with table 17 and figure 3 of this section to calculate permissible edge distance, spacing and concrete thickness combinations.

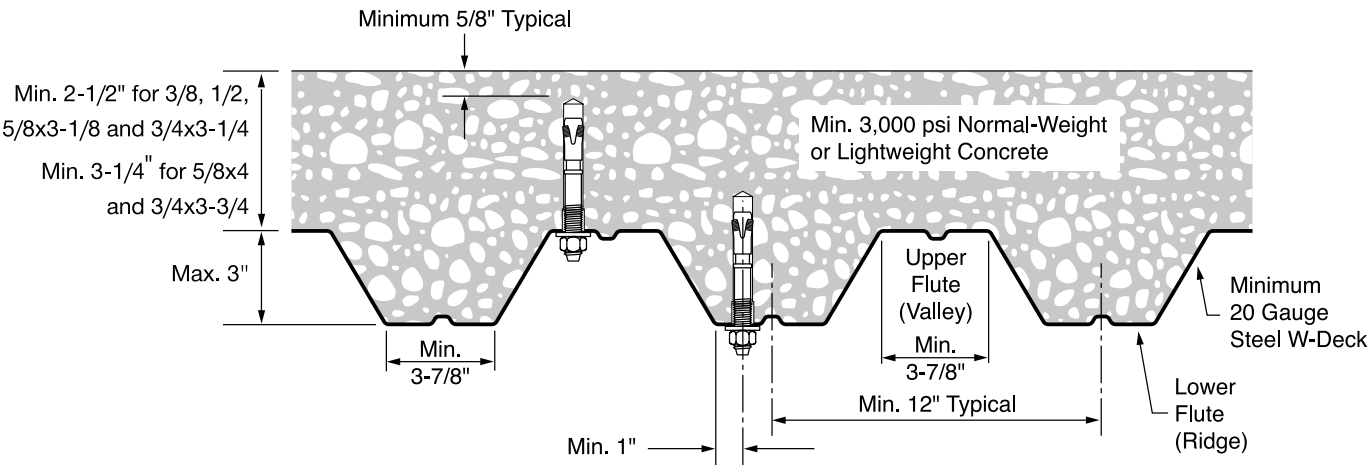


Figure 4 - Installation of Hilti KWIK Bolt TZ in the soffit of concrete over metal deck floor and roof assemblies - W Deck

3.3.5

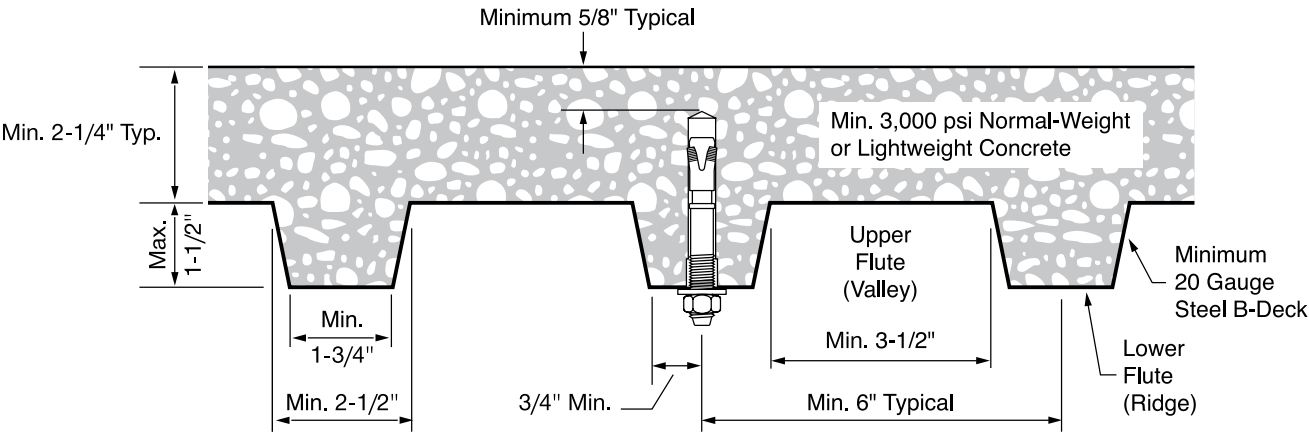


Figure 5 - Installation of Hilti KWIK Bolt TZ in the soffit of concrete over metal deck floor and roof assemblies - B Deck

Table 27 - Hilti KWIK Bolt TZ carbon steel design strength in the soffit of uncracked lightweight concrete over metal deck^{1,2,3,4,5,6}

Nominal anchor diameter in.	Effective embed. depth in. (mm)	Nominal embed. depth in. (mm)	Loads according to Figure 4				Loads according to Figure 5			
			Tension - ϕN_n		Shear - ϕV_n		Tension - ϕN_n		Shear - ϕV_n	
			$f'_c = 3,000$ psi (20.7 MPa) lb (kN)	$f'_c = 4,000$ psi (27.6 MPa) lb (kN)	$f'_c = 3,000$ psi (20.7 MPa) lb (kN)	$f'_c = 4,000$ psi (27.6 MPa) lb (kN)	$f'_c = 3,000$ psi (20.7 MPa) lb (kN)	$f'_c = 4,000$ psi (27.6 MPa) lb (kN)	$f'_c = 3,000$ psi (20.7 MPa) lb (kN)	$f'_c = 4,000$ psi (27.6 MPa) lb (kN)
3/8	1-1/2 (38)	1-13/16 (46)	750 (3.3)	865 (3.8)	1,135 (5.0)	1,135 (5.0)	705 (3.1)	815 (3.6)	1,200 (5.3)	1,200 (5.3)
	2 (51)	2-5/16 (59)	1,305 (5.8)	1,505 (6.7)	1,385 (6.2)	1,385 (6.2)	1,200 (5.3)	1,385 (6.2)	1,850 (8.2)	1,850 (8.2)
	2-3/4 (70)	2-5/16 (59)	1,995 (8.9)	2,305 (10.3)	1,765 (7.9)	1,765 (7.9)	n/a	n/a	n/a	n/a
1/2	2 (51)	2-3/8 (60)	1,305 (5.8)	1,505 (6.7)	1,690 (7.5)	1,690 (7.5)	1,210 (5.4)	1,395 (6.2)	1,680 (7.5)	1,680 (7.5)
	3-1/4 (83)	3-5/8 (92)	2,400 (10.7)	2,770 (12.3)	2,640 (11.7)	2,640 (11.7)	2,195 (9.8)	2,535 (11.3)	2,565 (11.4)	2,565 (11.4)
5/8	3-1/8 (79)	3-9/16 (90)	1,835 (8.2)	2,120 (9.4)	2,990 (13.3)	2,990 (13.3)	2,640 (11.7)	3,050 (13.6)	3,060 (13.6)	3,060 (13.6)
	4 (102)	4-7/16 (113)	3,385 (15.1)	3,910 (17.4)	3,650 (16.2)	3,650 (16.2)	n/a	n/a	n/a	n/a
3/4	3-1/4 (83)	3-13/16 (97)	2,750 (12.2)	3,175 (14.1)	3,145 (14.0)	3,145 (14.0)	n/a	n/a	n/a	n/a
	3-3/4 (95)	4-5/16 (110)	2,765 (12.3)	3,195 (14.2)	4,025 (17.9)	4,025 (17.9)	n/a	n/a	n/a	n/a

Table 28 - Hilti KWIK Bolt TZ carbon steel design strength in the soffit of cracked lightweight concrete over metal deck^{1,2,3,4,5,6,7}

Nominal anchor diameter in.	Effective embed. depth in. (mm)	Nominal embed. depth in. (mm)	Loads according to Figure 4				Loads according to Figure 5			
			Tension - ϕN_n		Shear - ϕV_n		Tension - ϕN_n		Shear - ϕV_n	
			$f'_c = 3,000$ psi (20.7 MPa) lb (kN)	$f'_c = 4,000$ psi (27.6 MPa) lb (kN)	$f'_c = 3,000$ psi (20.7 MPa) lb (kN)	$f'_c = 4,000$ psi (27.6 MPa) lb (kN)	$f'_c = 3,000$ psi (20.7 MPa) lb (kN)	$f'_c = 4,000$ psi (27.6 MPa) lb (kN)	$f'_c = 3,000$ psi (20.7 MPa) lb (kN)	$f'_c = 4,000$ psi (27.6 MPa) lb (kN)
3/8	1-1/2 (38)	1-13/16 (46)	630 (2.8)	725 (3.2)	1,135 (5.0)	1,135 (5.0)	595 (2.6)	685 (3.0)	1,200 (5.3)	1,200 (5.3)
	2 (51)	2-5/16 (59)	925 (4.1)	1,070 (4.8)	1,385 (6.2)	1,385 (6.2)	1,080 (4.8)	1,245 (5.5)	1,850 (8.2)	1,850 (8.2)
	2-3/4 (70)	2-5/16 (59)	1,535 (6.8)	1,770 (7.9)	1,495 (6.7)	1,495 (6.7)	n/a	n/a	n/a	n/a
1/2	2 (51)	2-3/8 (60)	925 (4.1)	1,070 (4.8)	1,690 (7.5)	1,690 (7.5)	860 (3.8)	995 (4.4)	1,680 (7.5)	1,680 (7.5)
	3-1/4 (83)	3-5/8 (92)	1,705 (7.6)	1,970 (8.8)	2,640 (11.7)	2,640 (11.7)	1,955 (8.7)	2,255 (10.0)	2,565 (11.4)	2,565 (11.4)
5/8	3-1/8 (79)	3-9/16 (90)	1,300 (5.8)	1,500 (6.7)	2,990 (13.3)	2,990 (13.3)	1,875 (8.3)	2,165 (9.6)	3,060 (13.6)	3,060 (13.6)
	4 (102)	4-7/16 (113)	2,520 (11.2)	2,910 (12.9)	3,650 (16.2)	3,650 (16.2)	n/a	n/a	n/a	n/a
3/4	3-1/4 (83)	3-13/16 (97)	1,950 (8.7)	2,250 (10.0)	3,145 (14.0)	3,145 (14.0)	n/a	n/a	n/a	n/a
	3-3/4 (95)	4-5/16 (110)	2,060 (9.2)	2,380 (10.6)	4,025 (17.9)	4,025 (17.9)	n/a	n/a	n/a	n/a

- See section 3.1.8 to convert design strength value to ASD value.
- Linear interpolation between embedment depths and concrete compressive strengths is not permitted.
- Tabular value is for one anchor per flute. Minimum spacing along the length of the flute is $3 \times h_{ef}$ (effective embedment).
- Tabular value is for lightweight concrete and no additional reduction factor is needed.
- No additional reduction factors for spacing or edge distance need to be applied.
- Comparison to steel values in table 4 is not required. Values in tables 28 and 29 control.
- Tabular values are for static loads only. Seismic design is not permitted for uncracked concrete. For seismic tension loads, multiply cracked concrete tabular values in tension only by $\alpha_{N,seis} = 0.75$.
See section 3.1.8 for additional information on seismic applications.
- For the following anchor sizes, an additional factor must be applied to the cracked concrete tabular values for seismic shear conditions:
3/8-in diameter with 1-1/2" effective embedment - $\alpha_{V,seis} = 0.77$, 3/8-inch diameter with 2" and 2-3/4" effective embedment - $\alpha_{V,seis} = 0.63$
5/8-inch diameter - $\alpha_{V,seis} = 0.94$
3/4-inch diameter with 3-1/4" effective embedment - $\alpha_{V,seis} = 0.80$, 3/4-inch diameter - $\alpha_{V,seis} = 0.86$

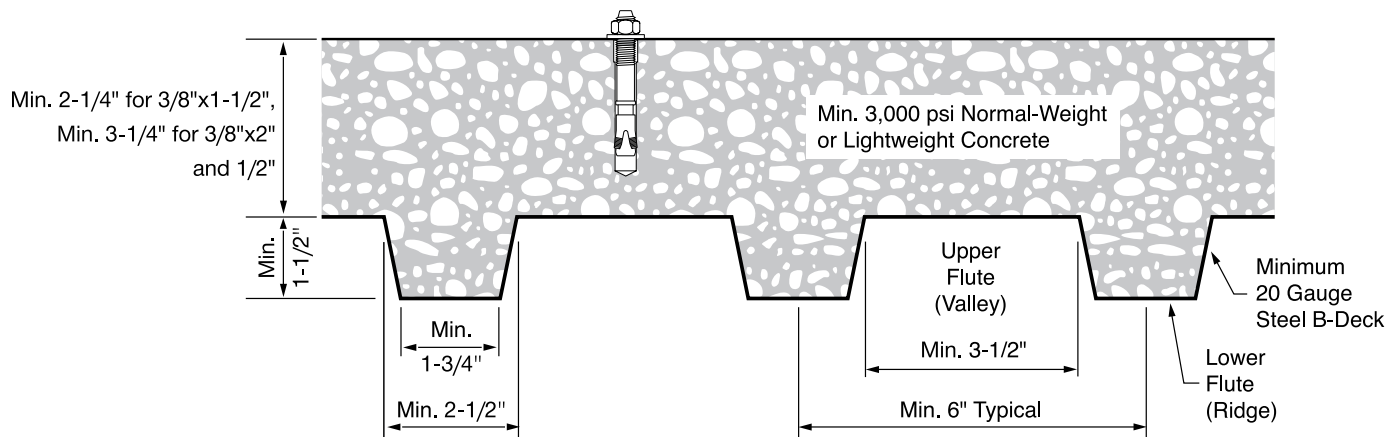


Figure 6 - Installation of the Hilti KWIK Bolt TZ on the top of sand-lightweight concrete over metal deck floor and roof assemblies

3.3.5

Table 29 - Hilti KWIK Bolt TZ carbon steel design strength in the top of uncracked concrete over metal deck^{1,2,3,4,5}

Nominal anchor diameter in.	Effective embed. in. (mm)	Nominal embed. in. (mm)	Tension - ϕN_n		Shear - ϕV_n	
			$f'_c = 3,000$ psi lb (kN)	$f'_c = 4,000$ psi lb (kN)	$f'_c = 3,000$ psi lb (kN)	$f'_c = 4,000$ psi lb (kN)
3/8	1-1/2 (38)	1-13/16 (46)	1,300 (5.8)	1,500 (6.7)	1,690 (7.5)	1,950 (8.7)
	2 (51)	2-5/16 (59)	1,790 (8.0)	2,070 (9.2)	2,605 (11.6)	3,005 (13.4)
1/2	2 (51)	2-3/8 (60)	2,415 (10.7)	2,790 (12.4)	2,605 (11.6)	3,005 (13.4)

Table 30 - Hilti KWIK Bolt TZ carbon steel design strength in the top of cracked concrete over metal deck^{1,2,3,4,5}

Nominal anchor diameter in.	Effective embed. in. (mm)	Nominal embed. in. (mm)	Tension - ϕN_n		Shear - ϕV_n	
			$f'_c = 3,000$ psi lb (kN)	$f'_c = 4,000$ psi lb (kN)	$f'_c = 3,000$ psi lb (kN)	$f'_c = 4,000$ psi lb (kN)
3/8	1-1/2 (38)	1-13/16 (46)	940 (4.2)	1,085 (4.8)	1,195 (5.3)	1,385 (6.2)
	2 (51)	2-5/16 (59)	1,615 (7.2)	1,865 (8.3)	1,845 (8.2)	2,130 (9.5)
1/2	2 (51)	2-3/8 (60)	1,710 (7.6)	1,975 (8.8)	1,845 (8.2)	2,130 (9.5)

- 1 See section 3.1.8 to convert design strength value to ASD value.
- 2 Linear interpolation between embedment depths and concrete compressive strengths is not permitted.
- 3 Apply spacing, edge distance, and concrete thickness factors in tables 31 and 32 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, $\lambda_a = 0.68$; for all-lightweight, $\lambda_a = 0.60$
- 5 Tabular values are for static loads only. Seismic design is not permitted for uncracked concrete. For seismic tension loads, multiply cracked concrete tabular values in tension only by $\alpha_{N,seis} = 0.75$.
No reduction needed for seismic shear. See section 3.1.8 for additional information on seismic applications.

Table 31 - Load adjustment factors for carbon steel Hilti KWIK Bolt TZ in the top of uncracked concrete over metal deck^{1,2}

3/8-in. and 1/2-in. KB-TZ CS 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}			to and away from edge f_{RV}					
		Anchor diameter d_a	in. (mm)	3/8 (9.5)	3/8 (9.5)	1/2 (12.7)	3/8 (9.5)	3/8 (9.5)	1/2 (12.7)	3/8 (9.5)	3/8 (9.5)	1/2 (12.7)	3/8 (9.5)	3/8 (9.5)	1/2 (12.7)	3/8 (9.5)	3/8 (9.5)	1/2 (12.7)	
Effective embed. h_{ef}	in. (mm)	1-1/2 (38)	2 (51)	2 (51)	1-1/2 (38)	2 (51)	2 (51)	1-1/2 (38)	2 (51)	2 (51)	1-1/2 (38)	2 (51)	2 (51)	1-1/2 (38)	2 (51)	2 (51)	1-1/2 (38)	2 (51)	2 (51)
Nominal embed. h_{nom}	in. (mm)	1-13/16 (46)	2-5/16 (59)	2-3/8 (60)	1-13/16 (46)	2-5/16 (59)	2-3/8 (60)	1-13/16 (46)	2-5/16 (59)	2-3/8 (60)	1-13/16 (46)	2-5/16 (59)	2-3/8 (60)	1-13/16 (46)	2-5/16 (59)	2-3/8 (60)	1-13/16 (46)	2-5/16 (59)	2-3/8 (60)
Spacing (s)/edge distance (c_a)/concrete thickness (h) - in. (mm)	2-1/4 (57)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	0.500	n/a	n/a
	3 (76)	n/a	n/a	n/a	n/a	0.33	n/a	n/a	n/a	n/a	n/a	0.33	n/a	n/a	0.33	n/a	0.58	n/a	n/a
	3-1/4 (83)	n/a	n/a	n/a	n/a	0.36	n/a	n/a	n/a	n/a	n/a	0.36	n/a	n/a	0.36	n/a	0.60	0.73	0.76
	3-1/2 (89)	n/a	n/a	n/a	n/a	0.39	n/a	n/a	n/a	n/a	n/a	0.39	n/a	n/a	0.39	n/a	0.62	0.76	0.78
	4 (102)	n/a	0.83	n/a	n/a	0.44	n/a	n/a	0.67	n/a	n/a	0.44	n/a	n/a	0.44	n/a	0.67	0.81	0.84
	4-1/2 (114)	n/a	0.88	n/a	n/a	0.50	0.50	n/a	0.67	n/a	n/a	0.50	0.50	n/a	0.50	0.50			
	5 (127)	n/a	0.92	n/a	n/a	0.56	0.56	n/a	0.71	n/a	n/a	0.56	0.56	n/a	0.56	0.56			
	5-1/2 (140)	n/a	0.96	n/a	n/a	0.61	0.61	n/a	0.73	n/a	n/a	0.61	0.61	n/a	0.61	0.61			
	6 (152)	n/a	1.00	n/a	n/a	0.67	0.67	n/a	0.75	n/a	n/a	0.67	0.67	n/a	0.67	0.67			
	6-1/2 (165)	n/a		1.00	n/a	0.72	0.72	n/a	0.77	0.79	n/a	0.72	0.72	n/a	0.72	0.72			
	7 (178)	n/a			n/a	0.78	0.78	n/a	0.79	0.81	n/a	0.78	0.78	n/a	0.78	0.78			
	8 (203)	1.00			n/a	0.89	0.89	0.72	0.83	0.85	n/a	0.89	0.89	n/a	0.89	0.89			
	9 (229)				n/a	1.00	1.00	0.75	0.87	0.89	n/a	1.00	1.00	n/a	1.00	1.00			
	10 (254)				n/a			0.78	0.91	0.94	n/a			n/a					
	11 (279)				n/a			0.81	0.96	0.98	n/a			n/a					
	12 (305)				n/a			0.83	1.00	1.00	n/a			n/a					
	13 (330)				n/a			0.86			n/a			n/a					
	16 (406)				1.00			0.94			1.00			1.00					

Table 32 - Load adjustment factors for carbon steel Hilti KWIK Bolt TZ in the top of cracked concrete over metal deck^{1,2}

3/8-in. and 1/2-in. KB-TZ CS cracked 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}			to and away from edge f_{RV}						
		Anchor diameter d_a	in. (mm)	3/8 (9.5)	3/8 (9.5)	1/2 (12.7)	3/8 (9.5)	3/8 (9.5)	1/2 (12.7)	3/8 (9.5)	3/8 (9.5)	1/2 (12.7)	3/8 (9.5)	3/8 (9.5)	1/2 (12.7)	3/8 (9.5)	3/8 (9.5)	1/2 (12.7)		
Effective embed. h_{ef}		in. (mm)	1-1/2 (38)	2 (51)	2 (51)	1-1/2 (38)	2 (51)	2 (51)	1-1/2 (38)	2 (51)	2 (51)	1-1/2 (38)	2 (51)	2 (51)	1-1/2 (38)	2 (51)	2 (51)			
Nominal embed. h_{nom}		in. (mm)	1-13/16 (46)	2-5/16 (59)	2-3/8 (60)	1-13/16 (46)	2-5/16 (59)	2-3/8 (60)	1-13/16 (46)	2-5/16 (59)	2-3/8 (60)	1-13/16 (46)	2-5/16 (59)	2-3/8 (60)	1-13/16 (46)	2-5/16 (59)	2-3/8 (60)			
Spacing (s)/edge distance (c_a)/concrete thickness (h) - in. (mm)	2-1/4 (57)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	0.693	n/a	n/a		
	3 (76)	n/a	n/a	n/a	n/a	1.00	n/a	n/a	n/a	n/a	n/a	n/a	0.65	n/a	n/a	1.00	n/a	0.80	n/a	n/a
	3-1/4 (83)	n/a	n/a	n/a	n/a		n/a	n/a	n/a	n/a	n/a	n/a	0.73	n/a	n/a		n/a	0.83	0.74	0.76
	3-1/2 (89)	n/a	n/a	n/a	n/a		n/a	n/a	n/a	n/a	n/a	n/a	0.82	n/a	n/a		n/a	0.86	0.76	0.79
	4 (102)	n/a	0.83	n/a	n/a		n/a	n/a	0.67	n/a	n/a	n/a	1.00	n/a	n/a		n/a	0.92	0.82	0.84
	4-1/2 (114)	n/a	0.88	n/a	n/a		1.00	n/a	0.69	n/a	n/a	n/a		1.00	n/a		1.00			
	5 (127)	n/a	0.92	n/a	n/a			n/a	0.71	n/a	n/a	n/a			n/a					
	5-1/2 (140)	n/a	0.96	n/a	n/a			n/a	0.73	n/a	n/a	n/a			n/a					
	6 (152)	n/a	1.00	n/a	n/a			n/a	0.75	n/a	n/a	n/a			n/a					
	6-1/2 (165)	n/a		1.00	n/a			n/a	0.77	0.79	n/a	n/a			n/a					
	7 (178)	n/a			n/a			n/a	0.79	0.81	n/a	n/a			n/a					
	8 (203)	n/a			n/a			0.93	0.83	0.85	n/a	n/a			n/a					
	9 (229)	1.00			n/a			0.98	0.87	0.90	n/a	n/a			n/a					
	10 (254)				n/a			1.00	0.92	0.94	n/a	n/a			n/a					
	11 (279)				n/a				0.96	0.98	n/a	n/a			n/a					
	12 (305)				n/a				1.00	1.00	n/a	n/a			n/a					
13 (330)				n/a						n/a	n/a			n/a						
16 (406)				1.00						1.00	1.00			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 318-14 Chapter 17.

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

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

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

DESIGN INFORMATION IN CONCRETE PER CSA A23.3

Limit State Design of anchors is described in the provisions of CSA A23.3-14 Annex D for post-installed anchors tested and assessed in accordance with ACI 355.2 for mechanical anchors and ACI 355.4 for adhesive anchors. This section contains the Limit State Design tables with unfactored characteristic loads that are based on the published loads in ICC Evaluation Services ESL-1067. These tables are followed by factored resistance tables. The factored resistance tables have characteristic design loads that are prefactored by the applicable reduction factors for a single anchor with no anchor-to-anchor spacing or edge distance adjustments for the convenience of the user of this document. All the figures in the previous ACI 318-14 Chapter 17 design section are applicable to Limit State Design and the tables will reference these figures.

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

Table 33 - Steel resistance for Hilti KWIK Bolt TZ carbon steel anchors^{1,2}



Nominal anchor diameter in.	Effective anchor embedment in. (mm)			Tensile N_{sar}^3 lb (kN)	Shear V_{sar}^4 lb (kN)	Seismic shear $V_{sar,eq}^5$ lb (kN)
3/8	1-1/2 (38)			4,410 (19.6)	1,390 (6.2)	1,390 (6.2)
	2 (51)	2-3/4 (70)		4,410 (19.6)	2,290 (10.2)	1,440 (6.4)
1/2	2 (51)	3-1/4 (83)		7,280 (32.4)	3,505 (15.6)	3,505 (15.6)
5/8	3-1/8 (79)	4 (102)		11,675 (51.9)	5,155 (22.9)	4,845 (21.6)
3/4	3-1/4 (83)	3-3/4 (95)	4-3/4 (121)	17,080 (76.0)	8,720 (38.8)	7,485 (33.3)

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

Table 34 - Steel resistance for Hilti KWIK Bolt TZ stainless steel anchors^{1,2}



Nominal anchor diameter in.	Tensile N_{sar}^3 lb (kN)	Shear V_{sar}^4 lb (kN)	Seismic Shear $V_{sar,eq}^5$ lb (kN)
3/8	4,060 (18.1)	3,010 (13.4)	1,800 (8.0)
1/2	7,890 (35.1)	4,385 (19.5)	4,385 (19.5)
5/8	12,680 (56.4)	6,290 (28.0)	5,960 (26.5)
3/4	16,355 (72.8)	10,015 (44.5)	8,215 (36.5)

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

Table 35 - Hilti KWIK Bolt TZ carbon steel design information in accordance with CSA A23.3-14¹


Design parameter	Symbol	Units	Nominal anchor diameter														Ref	
			3/8			1/2				5/8			3/4				A23.3-14	
Nominal anchor diameter	d _a	in. (mm)	0.375 (9.5)			0.5 (12.7)				0.625 (15.9)			0.75 (19.1)					
Effective minimum embedment ²	h _{ef}	in. (mm)	1-1/2 (38)	2 (51)		2-3/4 (70)	2 (51)		3-1/4 (83)		3-1/8 (79)	4 (102)		3-1/4 (83)	3-3/4 (95)		4-3/4 (121)	
Min. member thickness ³	h _{min}	in. (mm)	3-1/4 (83)	4 (102)	5 (127)	5 (127)	4 (102)	6 (152)	6 (152)	8 (203)	5 (127)	6 (152)	8 (203)	5-1/2 (140)	6 (152)	8 (203)	8 (203)	
Critical edge distance	c _{ac}	in. (mm)	6 (152)	4-3/8 (111)	4 (102)	4-1/8 (105)	5-1/2 (140)	4-1/2 (114)	7-1/2 (191)	6 (152)	6-1/2 (165)	8-3/4 (222)	6-3/4 (171)	12 (305)	10 (254)	8 (203)	9 (229)	
Min. edge distance	c _{min}	in. (mm)	8 (203)	2-1/2 (64)		2-1/2 (64)	2-3/4 (70)		2-3/8 (60)		3-5/8 (92)	3-1/4 (83)		9-1/2 (241)	4-3/4 (121)		4-1/8 (105)	
	for s >	in. (mm)	8 (203)	5 (127)		5 (127)	5-3/4 (146)		5-3/4 (146)		6-1/8 (156)	5-7/8 (149)		5 (127)	10-1/2 (267)		8-7/8 (225)	
Min. anchor spacing	s _{min}	in. (mm)	8 (203)	2-1/2 (64)		2-1/2 (64)	2-3/4 (70)		2-3/8 (60)		3-1/2 (89)	3 (76)		5 (127)	5 (127)		4 (102)	
	for c >	in. (mm)	8 (203)	3-5/8 (92)		3-5/8 (92)	4-1/8 (105)		3-1/2 (89)		4-3/4 (121)	4-1/4 (108)		9-1/2 (241)	9-1/2 (241)		7-3/4 (197)	
Min. hole depth in concrete	h _o	in. (mm)	2 (51)	2-5/8 (67)		3-3/8 (86)	2-5/8 (67)		4 (102)		3-7/8 (98)	4-3/4 (121)		4 (102)	4-5/8 (117)		5-3/4 (146)	
Min. specified yield strength	f _{ya}	psi (N/mm ²)	100,000 (690)				84,800 (585)				84,800 (585)			84,800 (585)				
Min. specified ult. strength	f _{uta}	psi (N/mm ²)	125,000 (862)				106,000 (731)				106,000 (731)			106,000 (731)				
Effective tensile stress area	A _{se,N}	in ² (mm ²)	0.052 (33.6)				0.101 (65.0)				0.162 (104.6)			0.237 (152.8)				
Steel embed. material resistance factor for reinforcement	ϕ _s	-	0.85														8.4.3	
Resistance modification factor for tension, steel failure modes ⁴	R	-	0.80														D.5.3	
Resistance modification factor for shear, steel failure modes ⁴	R	-	0.75														D.5.3	
Factored steel resistance in tension	N _{sar}	lb (kN)	4,410 (19.7)				7,280 (32.4)				11,675 (51.9)			17,080 (76.0)				D.6.1.2
Factored steel resistance in shear	V _{sar}	lb (kN)	1,390 (6.2)	2,290 (10.2)		3,505 (15.6)				5,155 (22.9)			8,720 (38.8)				D.7.1.2	
Factored steel resistance in shear, seismic	V _{sar,eq}	lb (kN)	1,390 (6.2)	1,440 (6.4)		3,505 (15.6)				4,845 (21.6)			7,485 (33.3)					
Coeff. for factored concrete breakout resistance, uncracked concrete	k _{c,uncr}	-	10														D.6.2.2	
Coeff. for factored concrete breakout resistance, cracked concrete	k _{c,cr}	-	7														D.6.2.2	
Modification factor for anchor resistance, tension, uncracked concrete ⁵	ψ _{c,N}	-	1.0														D.6.2.6	
Anchor category	-	-	2	1														D.5.3 (c)
Concrete material resistance factor	ϕ _c	-	0.65														8.4.2	
Resistance modification factor for tension and shear, concrete failure modes, Condition B ⁶	R	-	0.85	1.00														D.5.3 (c)
Factored pullout resistance in 20 MPa uncracked concrete ⁷	N _{pr,uncr}	lb (kN)	1,285 (5.7)	1,765 (7.8)	2,880 (12.8)	N/A		3,855 (17.2)	N/A		6,405 (28.5)	N/A		5,795 (25.8)	7,480 (33.3)			D.6.3.2
Factored pullout resistance in 20 MPa cracked concrete ⁷	N _{pr,cr}	lb (kN)	N/A	1,590 (7.1)	2,220 (9.9)	N/A		3,450 (15.3)	N/A		N/A	N/A		N/A	N/A			D.6.3.2

1 Design information in this table is taken from ICC-ES ESR-1067, dated September 2016, table 3, and converted for use with CSA A23.3-14 Annex D.

2 See figure 1 of this section.

3 For concrete over metal deck applications where the concrete thickness over the top flange is less than h_{min} in this table, see figure 6 and tables 43 and 44 of this section.

4 The carbon steel KWIK Bolt TZ is considered a ductile steel element as defined by CSA A23.3-14 Annex D section D.2.

5 For all design cases, $\psi_{c,N} = 1.0$. The appropriate coefficient for breakout resistance for cracked concrete ($k_{c,cr}$) or uncracked concrete ($k_{c,uncr}$) must be used.

6 For use with the load combinations of CSA A23.3-14 chapter 8. Condition B applies where supplementary reinforcement in conformance with CSA A23.3-14 section D.5.3 is not provided, or where pullout or pryout strength governs. For cases where the presence of supplementary reinforcement can be verified, the resistance modification factors associated with Condition A may be used.

7 For all design cases, $\psi_{c,p} = 1.0$. NA (not applicable) denotes that this value does not control for design. See section 4.1.4 of ESR-1067 for additional information.



Table 36 - Hilti KWIK Bolt TZ carbon steel factored resistance with concrete/pullout failure in uncracked concrete^{1,2,3,4}

Nominal anchor diameter in.	Effective embed. in. (mm)	Nominal embed. in. (mm)	Tension - N_t				Shear - V_r			
			$f'_c = 20$ MPa (2,900 psi) lb (kN)	$f'_c = 25$ MPa (3,625 psi) lb (kN)	$f'_c = 30$ MPa (4,350 psi) lb (kN)	$f'_c = 40$ MPa (5,800 psi) lb (kN)	$f'_c = 20$ MPa (2,900 psi) lb (kN)	$f'_c = 25$ MPa (3,625 psi) lb (kN)	$f'_c = 30$ MPa (4,350 psi) lb (kN)	$f'_c = 40$ MPa (5,800 psi) lb (kN)
3/8	1-1/2 (38)	1-13/16 (46)	1,285 (5.8)	1,435 (6.5)	1,575 (7.0)	1,815 (8.1)	1,300 (5.8)	1,455 (6.5)	1,595 (7.1)	1,840 (8.2)
	2 (51)	2-5/16 (59)	1,765 (7.8)	1,970 (8.8)	2,160 (9.6)	2,495 (11.1)	2,380 (10.6)	2,660 (11.8)	2,915 (13.0)	3,365 (15.0)
	2-3/4 (70)	3-1/16 (78)	2,880 (12.8)	3,220 (14.3)	3,530 (15.7)	4,075 (18.1)	7,655 (34.0)	8,560 (38.1)	9,375 (41.7)	10,825 (48.2)
1/2	2 (51)	2-3/8 (60)	2,380 (10.6)	2,660 (11.8)	2,915 (13.0)	3,365 (15.0)	2,380 (10.6)	2,660 (11.8)	2,915 (13.0)	3,365 (15.0)
	3-1/4 (83)	3-5/8 (92)	3,855 (17.2)	4,310 (19.2)	4,725 (21.0)	5,455 (24.3)	9,885 (44.0)	11,050 (49.2)	12,105 (53.8)	13,975 (62.2)
5/8	3-1/8 (79)	3-9/16 (90)	4,590 (20.4)	5,130 (22.8)	5,620 (25.0)	6,490 (28.9)	9,175 (40.8)	10,260 (45.6)	11,240 (50.0)	12,980 (57.7)
	4 (102)	4-7/16 (113)	6,405 (28.5)	7,165 (31.9)	7,845 (34.9)	9,060 (40.3)	13,465 (59.9)	15,055 (67.0)	16,490 (73.4)	19,040 (84.7)
3/4	3-1/4 (83)	3-13/16 (97)	4,940 (22.0)	5,525 (24.6)	6,050 (26.9)	6,990 (31.1)	9,885 (44.0)	11,050 (49.2)	12,105 (53.8)	13,975 (62.2)
	3-3/4 (95)	4-5/16 (110)	5,795 (25.8)	6,475 (28.8)	7,095 (31.6)	8,195 (36.4)	12,100 (53.8)	13,530 (60.2)	14,820 (65.9)	17,115 (76.1)
	4-3/4 (121)	5-9/16 (141)	7,480 (33.3)	8,360 (37.2)	9,160 (40.7)	10,575 (47.0)	17,395 (77.4)	19,450 (86.5)	21,305 (94.8)	24,600 (109.4)

3.3.5

Table 37 - Hilti KWIK Bolt TZ carbon steel factored resistance with concrete/pullout failure in cracked concrete^{1,2,3,4,5}



Nominal anchor diameter in.	Effective embed. in. (mm)	Nominal embed. in. (mm)	Tension - N_t				Shear - V_r			
			$f'_c = 20$ MPa (2,900 psi) lb (kN)	$f'_c = 25$ MPa (3,625 psi) lb (kN)	$f'_c = 30$ MPa (4,350 psi) lb (kN)	$f'_c = 40$ MPa (5,800 psi) lb (kN)	$f'_c = 20$ MPa (2,900 psi) lb (kN)	$f'_c = 25$ MPa (3,625 psi) lb (kN)	$f'_c = 30$ MPa (4,350 psi) lb (kN)	$f'_c = 40$ MPa (5,800 psi) lb (kN)
3/8	1-1/2 (38)	1-13/16 (46)	910 (4.1)	1,020 (4.5)	1,115 (5.0)	1,290 (5.7)	910 (4.1)	1,020 (4.5)	1,115 (5.0)	1,290 (5.7)
	2 (51)	2-5/16 (59)	1,590 (7.1)	1,780 (7.9)	1,945 (8.7)	2,250 (10.0)	1,665 (7.4)	1,865 (8.3)	2,040 (9.1)	2,355 (10.5)
	2-3/4 (70)	3-1/16 (78)	2,220 (9.9)	2,480 (11.0)	2,720 (12.1)	3,140 (14.0)	5,360 (23.8)	5,990 (26.6)	6,560 (29.2)	7,580 (33.7)
1/2	2 (51)	2-3/8 (60)	1,665 (7.4)	1,865 (8.3)	2,040 (9.1)	2,355 (10.5)	1,665 (7.4)	1,865 (8.3)	2,040 (9.1)	2,355 (10.5)
	3-1/4 (83)	3-5/8 (92)	3,450 (15.3)	3,855 (17.1)	4,225 (18.8)	4,875 (21.7)	6,920 (30.8)	7,735 (34.4)	8,475 (37.7)	9,785 (43.5)
5/8	3-1/8 (79)	3-9/16 (90)	3,210 (14.3)	3,590 (16.0)	3,935 (17.5)	4,545 (20.2)	6,425 (28.6)	7,180 (31.9)	7,870 (35.0)	9,085 (40.4)
	4 (102)	4-7/16 (113)	4,710 (21.0)	5,270 (23.4)	5,770 (25.7)	6,665 (29.6)	9,425 (41.9)	10,535 (46.9)	11,545 (51.3)	13,330 (59.3)
3/4	3-1/4 (83)	3-13/16 (97)	3,460 (15.4)	3,865 (17.2)	4,235 (18.8)	4,890 (21.8)	6,920 (30.8)	7,735 (34.4)	8,475 (37.7)	9,785 (43.5)
	3-3/4 (95)	4-5/16 (110)	4,235 (18.8)	4,735 (21.1)	5,190 (23.1)	5,990 (26.6)	8,470 (37.7)	9,470 (42.1)	10,375 (46.2)	11,980 (53.3)
	4-3/4 (121)	5-9/16 (141)	6,090 (27.1)	6,805 (30.3)	7,455 (33.2)	8,610 (38.3)	12,175 (54.2)	13,615 (60.6)	14,915 (66.3)	17,220 (76.6)

- See section 3.1.8 to convert design strength value to ASD value.
- Linear interpolation between embedment depths and concrete compressive strengths is not permitted.
- Apply spacing, edge distance, and concrete thickness factors in tables 6 to 13 as necessary. Compare to the steel values in table 33. The lesser of the values is to be used for the design.
- 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, $\lambda_a = 0.60$
- Tabular values are for static loads only. Seismic design is not permitted for uncracked concrete. For seismic tension loads, multiply cracked concrete tabular values in tension only by $\alpha_{N,seis} = 0.75$.
No reduction needed for seismic shear. See section 3.1.8 for additional information on seismic applications.

Table 38 - Hilti KWIK Bolt TZ stainless steel design information in accordance with CSA A23.3-14¹


Design parameter	Symbol	Units	Nominal anchor diameter										Ref			
			3/8		1/2			5/8			3/4		A23.3-14			
Nominal anchor diameter	d _a	in. (mm)	0.375 (9.5)		0.5 (12.7)			0.625 (15.9)			0.75 (19.1)					
Effective minimum embedment ²	h _{ef}	in. (mm)	2 (51)		2 (51)		3-1/4 (83)		3-1/8 (79)		4 (102)		3-3/4 (95)	4-3/4 (121)		
Min. concrete thickness	h _{min}	in. (mm)	4 (102)	5 (127)	4 (102)	6 (152)	6 (152)	8 (203)	5 (127)	6 (152)	8 (203)	6 (152)	8 (203)	8 (203)		
Critical edge distance	c _{ac}	in. (mm)	4-3/8 (111)	3-7/8 (98)	5-1/2 (140)	4-1/2 (114)	7-1/2 (191)	6 (152)	6-1/2 (165)	8-3/4 (222)	6-3/4 (171)	10 (254)	8 (203)	9 (229)		
Min. edge distance	c _{min}	in. (mm)	2-1/2 (64)		2-7/8 (73)		2-1/8 (54)		3-1/4 (83)		2-3/8 (60)		4-1/4 (108)		4 (102)	
	for s >	in. (mm)	5 (127)		5-3/4 (146)		5-1/4 (133)		5-1/2 (140)		5-1/2 (140)		10 (254)		8-1/2 (216)	
Min. anchor spacing	s _{min}	in. (mm)	2-1/4 (57)		2-7/8 (73)		2 (51)		2-3/4 (70)		2-3/8 (60)		5 (127)		4 (102)	
	for c >	in. (mm)	3-1/2 (89)		4-1/2 (114)		3-1/4 (83)		4-1/8 (105)		4-1/4 (108)		9-1/2 (241)		7 (178)	
Min. hole depth in concrete	h _o	in. (mm)	2-5/8 (67)		2-5/8 (67)		4 (102)		3-3/4 (98)		4-3/4 (121)		4-1/2 (117)		5-3/4 (146)	
Min. specified yield strength	f _{ya}	psi (N/mm ²)	92,000 (634)		92,000 (634)			92,000 (634)			76,125 (525)					
Min. specified ult. strength	f _{uta}	psi (N/mm ²)	115,000 (793)		115,000 (793)			115,000 (793)			101,500 (700)					
Effective tensile stress area	A _{se,N}	in ² (mm ²)	0.052 (33.6)		0.101 (65.0)			0.162 (104.6)			0.237 (152.8)					
Steel embed. material resistance factor for reinforcement	Φ _s	-	0.85												8.4.3	
Resistance modification factor for tension, steel failure modes ³	R	-	0.80												D.5.3	
Resistance modification factor for shear, steel failure modes ³	R	-	0.75												D.5.3	
Factored steel resistance in tension	N _{sar}	lb (kN)	4,060 (18.1)		7,890 (35.1)			12,680 (56.4)			16,355 (72.8)					D.6.1.2
Factored steel resistance in shear	V _{sar}	lb (kN)	3,010 (13.4)		4,385 (19.5)			6,290 (28.0)			10,015 (44.5)					D.7.1.2
Factored steel resistance in shear, seismic	V _{sar,eq}	lb (kN)	1,800 (8.0)		4,385 (19.5)			5,960 (26.5)			8,215 (36.5)					
Coeff. for factored concrete breakout resistance, uncracked concrete	k _{c,uncr}	-	10												D.6.2.2	
Coeff. for factored concrete breakout resistance, cracked concrete	k _{c,cr}	-	7		10		7		7			10		7	D.6.2.2	
Modification factor for anchor resistance, tension, uncracked concrete ⁴	ψ _{c,N}	-	1.0												D.6.2.6	
Anchor category	-	-	1		2		1		1			1		1	D.5.3 (c)	
Concrete material resistance factor	Φ _c	-	0.65												8.4.2	
Resistance modification factor for tension and shear, concrete failure modes, Condition B ⁵	R	-	1.00		0.85		1.00		1.00			1.00		1.00	D.5.3 (c)	
Factored pullout resistance in 20 MPa uncracked concrete ⁶	N _{pr,uncr}	lb (kN)	1,840 (8.2)		N/A		4,030 (17.9)		N/A			N/A		8,440 (37.5)	D.6.3.2	
Factored pullout resistance in 20 MPa cracked concrete ⁶	N _{pr,cr}	lb (kN)	1,635 (7.3)		1,885 (8.4)		NA		NA		4,095 (18.2)		5,685 (25.3)		NA	D.6.3.2
Factored seismic pullout resistance in 20 MPa cracked concrete ⁶	N _{pr,eq}	lb (kN)	1,635 (7.3)		1,635 (7.3)		NA		NA		4,095 (18.2)		5,685 (25.3)		NA	D.6.3.2

1 Design information in this table is taken from ICC ES ESL-1067, dated September 2016, table 4, and converted for use with CSA A23.3-14 Annex D.

2 See figure 1 of this section.

3 The stainless steel KWIK Bolt TZ is considered a ductile steel element as defined by CSA A23.3-14 Annex D section D.2.

4 For all design cases, $\psi_{c,N} = 1.0$. The appropriate coefficient for breakout resistance for cracked concrete ($k_{c,cr}$) or uncracked concrete ($k_{c,uncr}$) must be used.

5 For use with the load combinations of CSA A23.3-14 chapter 8. Condition B applies where supplementary reinforcement in conformance with CSA A23.3-14 section D.5.3 is not provided, or where pullout or pryout strength governs. For cases where the presence of supplementary reinforcement can be verified, the resistance modification factors associated with Condition A may be used.

6 For all design cases, $\psi_{c,p} = 1.0$. NA (not applicable) denotes that this value does not control for design. See section 4.1.4 of ES-1067 for additional information.



Table 39 - Hilti KWIK Bolt TZ stainless steel factored resistance with concrete/pullout failure in uncracked concrete^{1,2,3,4,5}

Nominal anchor diameter in.	Effective embed. in. (mm)	Nominal embed. in. (mm)	Tension - N_r				Shear - V_r			
			$f'_c = 20 \text{ MPa}$ (2,900 psi) lb (kN)	$f'_c = 25 \text{ MPa}$ (3,625 psi) lb (kN)	$f'_c = 30 \text{ MPa}$ (4,350 psi) lb (kN)	$f'_c = 40 \text{ MPa}$ (5,800 psi) lb (kN)	$f'_c = 20 \text{ MPa}$ (2,900 psi) lb (kN)	$f'_c = 25 \text{ MPa}$ (3,625 psi) lb (kN)	$f'_c = 30 \text{ MPa}$ (4,350 psi) lb (kN)	$f'_c = 40 \text{ MPa}$ (5,800 psi) lb (kN)
3/8	2 (51)	2-5/16 (59)	1,840 (8.2)	2,060 (9.2)	2,255 (10.0)	2,605 (11.6)	2,380 (10.6)	2,660 (11.8)	2,915 (13.0)	3,365 (15.0)
1/2	2 (51)	2 3/8 (60)	2,025 (9.0)	2,260 (10.1)	2,480 (11.0)	2,860 (12.7)	2,025 (9.0)	2,260 (10.1)	2,480 (11.0)	2,860 (12.7)
	3-1/4 (83)	3 5/8 (92)	4,030 (17.9)	4,505 (20.0)	4,935 (22.0)	5,700 (25.4)	9,885 (44.0)	11,050 (49.2)	12,105 (53.8)	13,975 (62.2)
5/8	3-1/8 (79)	3-9/16 (90)	4,590 (20.4)	5,130 (22.8)	5,620 (25.0)	6,490 (28.9)	9,175 (40.8)	10,260 (45.6)	11,240 (50.0)	12,980 (57.7)
	4 (102)	4-7/16 (113)	6,730 (29.9)	7,525 (33.5)	8,245 (36.7)	9,520 (42.3)	13,465 (59.9)	15,055 (67.0)	16,490 (73.4)	19,040 (84.7)
3/4	3-3/4 (95)	4-5/16 (110)	6,050 (26.9)	6,765 (30.1)	7,410 (33.0)	8,555 (38.1)	12,100 (53.8)	13,530 (60.2)	14,820 (65.9)	17,115 (76.1)
	4-3/4 (121)	5-9/16 (141)	8,440 (37.5)	9,435 (42.0)	10,335 (46.0)	11,935 (53.1)	17,395 (77.4)	19,450 (86.5)	21,305 (94.8)	24,600 (109.4)

3.3.5

Table 40 - Hilti KWIK Bolt TZ stainless steel factored resistance with concrete/pullout failure in cracked concrete^{1,2,3,4,5}

Nominal anchor diameter in.	Effective embed. in. (mm)	Nominal embed. in. (mm)	Tension - N_r				Shear - V_r			
			$f'_c = 20 \text{ MPa}$ (2,900 psi) lb (kN)	$f'_c = 25 \text{ MPa}$ (3,625 psi) lb (kN)	$f'_c = 30 \text{ MPa}$ (4,350 psi) lb (kN)	$f'_c = 40 \text{ MPa}$ (5,800 psi) lb (kN)	$f'_c = 20 \text{ MPa}$ (2,900 psi) lb (kN)	$f'_c = 25 \text{ MPa}$ (3,625 psi) lb (kN)	$f'_c = 30 \text{ MPa}$ (4,350 psi) lb (kN)	$f'_c = 40 \text{ MPa}$ (5,800 psi) lb (kN)
3/8	2 (51)	2-5/16 (59)	1,635 (7.3)	1,830 (8.1)	2,005 (8.9)	2,315 (10.3)	1,665 (7.4)	1,865 (8.3)	2,040 (9.1)	2,355 (10.5)
1/2	2 (51)	2 3/8 (60)	1,885 (8.4)	2,110 (9.4)	2,310 (10.3)	2,670 (11.9)	2,025 (9.0)	2,260 (10.1)	2,480 (11.0)	2,860 (12.7)
	3-1/4 (83)	3 5/8 (92)	3,460 (15.4)	3,865 (17.2)	4,235 (18.8)	4,890 (21.8)	6,920 (30.8)	7,735 (34.4)	8,475 (37.7)	9,785 (43.5)
5/8	3-1/8 (79)	3-9/16 (90)	3,210 (14.3)	3,590 (16.0)	3,935 (17.5)	4,545 (20.2)	6,425 (28.6)	7,180 (31.9)	7,870 (35.0)	9,085 (40.4)
	4 (102)	4-7/16 (113)	4,095 (18.2)	4,575 (20.4)	5,015 (22.3)	5,790 (25.7)	9,425 (41.9)	10,535 (46.9)	11,545 (51.3)	13,330 (59.3)
3/4	3-3/4 (95)	4-5/16 (110)	5,685 (25.3)	6,355 (28.3)	6,960 (31.0)	8,035 (35.8)	12,100 (53.8)	13,530 (60.2)	14,820 (65.9)	17,115 (76.1)
	4-3/4 (121)	5-9/16 (141)	6,090 (27.1)	6,805 (30.3)	7,455 (33.2)	8,610 (38.3)	12,175 (54.2)	13,615 (60.6)	14,915 (66.3)	17,220 (76.6)

- See section 3.1.8 to convert design strength value to ASD value.
- Linear interpolation between embedment depths and concrete compressive strengths is not permitted.
- Apply spacing, edge distance, and concrete thickness factors in tables 19 to 26 as necessary. Compare to the steel values in table 34. The lesser of the values is to be used for the design.
- 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, $\lambda_a = 0.60$
- Tabular values are for static loads only. Seismic design is not permitted for uncracked concrete. For seismic loads, multiply cracked concrete tabular values in tension only by $\alpha_{N,seis} = 0.75$.
For the 1/2-inch diameter by 2-inch effective embedment anchor, $\alpha_{N,seis} = 0.65$.
No reduction needed for seismic shear. See section 3.1.8 for additional information on seismic applications.

Table 41 - Hilti KWIK Bolt TZ carbon steel factored resistance in the soffit of uncracked lightweight concrete over metal deck^{1,2,3,4,5,6,7}



Nominal anchor diameter in.	Effective embedment in. (mm)	Nominal embedment in. (mm)	Loads according to Figure 4			Loads according to Figure 5		
			Tension - N_r		Shear - V_r	Tension - N_r		Shear - V_r
			$f'_c = 20$ MPa (2,900 psi) lb (kN)	$f'_c = 30$ MPa (4,350 psi) lb (kN)	$f'_c = 20$ MPa (2,900 psi) lb (kN)	$f'_c = 20$ MPa (2,900 psi) lb (kN)	$f'_c = 30$ MPa (4,350 psi) lb (kN)	$f'_c = 20$ MPa (2,900 psi) lb (kN)
3/8	1-1/2 (38)	1-13/16 (46)	740 (3.3)	910 (4.0)	1,115 (5.0)	700 (3.1)	855 (3.8)	1,175 (5.2)
	2 (51)	2-5/16 (59)	1,285 (5.7)	1,575 (7.0)	1,360 (6.0)	1,180 (5.2)	1,445 (6.4)	1,815 (8.1)
	2-3/4 (70)	3-1/16 (78)	1,965 (8.7)	2,405 (10.7)	1,730 (7.7)	n/a	n/a	n/a
1/2	2 (51)	2-3/8 (60)	1,285 (5.7)	1,575 (7.0)	1,655 (7.4)	1,190 (5.3)	1,460 (6.5)	1,650 (7.3)
	3-1/4 (83)	3-5/8 (92)	2,360 (10.5)	2,890 (12.9)	2,590 (11.5)	2,155 (9.6)	2,640 (11.7)	2,515 (11.2)
5/8	3-1/8 (79)	3-9/16 (90)	1,805 (8.0)	2,210 (9.8)	2,935 (13.1)	2,600 (11.6)	3,180 (14.1)	3,000 (13.3)
	4 (102)	4-7/16 (113)	3,330 (14.8)	4,080 (18.1)	3,580 (15.9)	n/a	n/a	n/a
3/4	3-1/4 (83)	3-13/16 (97)	2,705 (12.0)	3,315 (14.7)	3,085 (13.7)	n/a	n/a	n/a
	3-3/4 (95)	4-5/16 (110)	2,720 (12.1)	3,330 (14.8)	3,945 (17.5)	n/a	n/a	n/a

Table 42 - Hilti KWIK Bolt TZ carbon steel factored resistance in the soffit of cracked lightweight concrete over metal deck^{1,2,3,4,5,6,7}



Nominal anchor diameter in.	Effective embedment in. (mm)	Nominal embedment in. (mm)	Loads according to Figure 4			Loads according to Figure 5		
			Tension - N_r		Shear - V_r	Tension - N_r		Shear - V_r
			$f'_c = 20$ MPa (2,900 psi) lb (kN)	$f'_c = 30$ MPa (4,350 psi) lb (kN)	$f'_c = 20$ MPa (2,900 psi) lb (kN)	$f'_c = 20$ MPa (2,900 psi) lb (kN)	$f'_c = 30$ MPa (4,350 psi) lb (kN)	$f'_c = 20$ MPa (2,900 psi) lb (kN)
3/8	1-1/2 (38)	1-13/16 (46)	625 (2.8)	765 (3.4)	1,115 (5.0)	585 (2.6)	720 (3.2)	1,175 (5.2)
	2 (51)	2-5/16 (59)	935 (4.2)	1,145 (5.1)	1,360 ⁸ (6.0)	1,060 (4.7)	1,300 (5.8)	1,815 ⁸ (8.1)
	2-3/4 (70)	3-1/16 (78)	1,585 (7.1)	1,940 (8.6)	1,730 (7.7)	n/a	n/a	n/a
1/2	2 (51)	2-3/8 (60)	935 (4.2)	1,145 (5.1)	1,910 (8.5)	845 (3.8)	1,035 (4.6)	1,650 (7.3)
	3-1/4 (83)	3-5/8 (92)	1,675 (7.5)	2,050 (9.1)	3,150 (14.0)	1,920 (8.5)	2,350 (10.5)	2,515 (11.2)
5/8	3-1/8 (79)	3-9/16 (90)	1,280 (5.7)	1,565 (7.0)	2,935 ⁸ (13.1)	1,845 (8.2)	2,260 (10.1)	3,000 ⁸ (13.3)
	4 (102)	4-7/16 (113)	2,970 (13.2)	3,635 (16.2)	3,850 ⁸ (17.1)	n/a	n/a	n/a
3/4	3-1/4 (83)	3-13/16 (97)	1,920 (8.5)	2,350 (10.5)	3,085 ⁸ (13.7)	n/a	n/a	n/a
	3-3/4 (95)	4-5/16 (110)	2,025 (9.0)	2,480 (11.0)	3,945 ⁸ (17.5)	n/a	n/a	n/a

1 See section 3.1.8 to convert design strength value to ASD value.

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

3 Tabular value is for one anchor per flute. Minimum spacing along the length of the flute is $3 \times h_{ef}$ (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 27 and 28 control.

7 Tabular values are for static loads only. Seismic design is not permitted for uncracked concrete. For seismic tension loads, multiply cracked concrete tabular values in tension only by $\alpha_{N,seis} = 0.75$.

See section 3.1.8 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 shear conditions:

3/8-in diameter with 1-1/2" effective embedment - $\alpha_{V,seis} = 0.77$, 3/8-inch diameter with 2" and 2 3/4" effective embedment - $\alpha_{V,seis} = 0.63$

5/8-inch diameter - $\alpha_{V,seis} = 0.94$

3/4-inch diameter with 3-1/4" effective embedment - $\alpha_{V,seis} = 0.80$, 3/4-inch diameter with 3-3/4" effective embedment - $\alpha_{V,seis} = 0.86$

Table 43 - Hilti KWIK Bolt TZ carbon steel factored resistance in the top of uncracked concrete over metal deck^{1,2,3,4,5}

Nominal anchor diameter in.	Effective embedment in. (mm)	Nominal embedment in. (mm)	Tension - N_r		Shear - V_r	
			$f'_c = 20 \text{ MPa}$ (2,900 psi) lb (kN)	$f'_c = 30 \text{ MPa}$ (4,350 psi) lb (kN)	$f'_c = 20 \text{ MPa}$ (2,900 psi) lb (kN)	$f'_c = 30 \text{ MPa}$ (4,350 psi) lb (kN)
3/8	1-1/2 (38)	1-13/16 (46)	1,285 (5.7)	1,575 (7.0)	1,300 (5.8)	1,595 (7.1)
	2 (51)	2-5/16 (59)	1,765 (7.9)	2,160 (9.6)	2,380 (10.6)	2,915 (13.0)
1/2	2 (51)	2-3/8 (60)	2,380 (10.6)	2,915 (13.0)	2,380 (10.6)	2,915 (13.0)

Table 44 - Hilti KWIK Bolt TZ carbon steel factored resistance in the top of cracked concrete over metal deck^{1,2,3,4,5}

Nominal anchor diameter in.	Effective embedment in. (mm)	Nominal embedment in. (mm)	Tension - N_r		Shear - V_r	
			$f'_c = 20 \text{ MPa}$ (2,900 psi) lb (kN)	$f'_c = 30 \text{ MPa}$ (4,350 psi) lb (kN)	$f'_c = 20 \text{ MPa}$ (2,900 psi) lb (kN)	$f'_c = 30 \text{ MPa}$ (4,350 psi) lb (kN)
3/8	1-1/2 (38)	1-13/16 (46)	910 (4.0)	1,115 (5.0)	910 (4.0)	1,115 (5.0)
	2 (51)	2-5/16 (59)	1,590 (7.1)	1,945 (8.7)	1,665 (7.4)	2,040 (9.1)
1/2	2 (51)	2-3/8 (60)	1,665 (7.4)	2,040 (9.1)	1,665 (7.4)	2,040 (9.1)

3.3.5

- 1 See section 3.1.8 to convert design strength value to ASD value.
- 2 Linear interpolation between embedment depths and concrete compressive strengths is not permitted.
- 3 Apply spacing, edge distance, and concrete thickness factors in tables 19 to 26 as necessary. Compare to the steel values in table 33. 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, $\lambda_a = 0.60$
- 5 Tabular values are for static loads only. Seismic design is not permitted for uncracked concrete. For seismic tension loads, multiply cracked concrete tabular values in tension only by $\alpha_{N,seis} = 0.75$.
No reduction needed for seismic shear. See section 3.1.8 for additional information on seismic applications.

DESIGN INFORMATION IN MASONRY

Table 45 – Allowable tensile loads for carbon steel and stainless steel Hilti KB-TZ anchors in the face of grout-filled concrete masonry walls^{1,3,4,5,6}

Nominal anchor diameter in.	Nominal embedment in. (mm)	Allowable tensile capacity at s_{cr} and c_{cr} lb (kN)	Spacing			Edge distance		
			Critical spacing, s_{cr} in. (mm)	Minimum spacing, s_{min}^2 in. (mm)	Load multiplier at s_{min}	Critical edge distance, c_{cr} in. (mm)	Minimum edge distance, c_{min} in. (mm)	Load multiplier at c_{min}
3/8	2-5/16 (59)	515 (2.3)	9-1/4 (235)	3 (76)	0.49	12 (305)	4 (102)	0.70
1/2	2-3/8 (60)	565 (2.5)	9-1/2 (241)	4 (102)	0.49			0.85
	3-5/8 (92)	735 (3.3)	14-1/2 (368)		0.59			1.00
5/8	3-9/16 (90)	790 (3.5)	14-1/4 (362)	5 (127)	0.66			0.89
	4-7/16 (113)	870 (3.9)	17-3/4 (451)		0.60			1.00
3/4	4-5/16 (110)	1,060 (4.7)	17-1/4 (438)	6 (152)	0.45			0.80
	5-9/16 (141)	1,165 (5.2)	22-1/4 (565)		0.41			0.85

Table 46 – Allowable shear loads for carbon steel and stainless steel Hilti KB-TZ anchors in the face of grout-filled concrete masonry walls^{1,3,4,5,6}

Nominal anchor diameter in.	Nominal embedment in. (mm)		Allowable shear capacity at s _{cr} and c _{cr} lb (kN)		Spacing			Edge distance							
					Critical spacing, s _{cr} in. (mm)	Minimum spacing, s _{min} ² in. (mm)	Load multiplier at s _{min}	Critical edge distance, c _{cr} in. (mm)	Minimum edge distance, c _{min} in. (mm)	⊥ load multiplier at c _{min}	load multiplier at c _{min}				
3/8	2-5/16	(59)	625	(2.8)	9-1/4	(235)	3	(76)	0.5	12	(305)	4	(102)	0.81	1.00
1/2	2-3/8	(60)	940	(4.2)	9-1/2	(241)	4	(102)						0.45	0.85
	3-5/8	(92)	1,055	(4.7)	14-1/2	(368)								0.41	0.88
5/8	3-9/16	(90)	1,615	(7.2)	14-1/4	(362)	5	(127)						0.40	0.87
	4-7/16	(113)	1,860	(8.3)	17-3/4	(451)								0.38	0.90
3/4	4-5/16	(110)	1,615	(7.2)	17-1/4	(438)	6	(152)						0.40	0.87
	5-9/16	(141)	1,860	(8.3)	22-1/4	(565)								0.38	0.90

1 Values valid for anchors installed in face shells of Type 1, Grade N, lightweight, medium-weight, or normal-weight concrete masonry units conforming to ASTM C90. The masonry units must be fully grouted with coarse grout conforming to 2015 IBC Section 2103.3, 2012 IBC Section 2103.13, or 2009 and 2006 IBC Section 2103.12. Mortar must comply with 2015 IBC Section 2103.2, 2012 IBC Section 2103.9, or 2009 and 2006 IBC Section 2103.8. Masonry compressive strength must be at least 1,500 psi at the time of anchor installation.

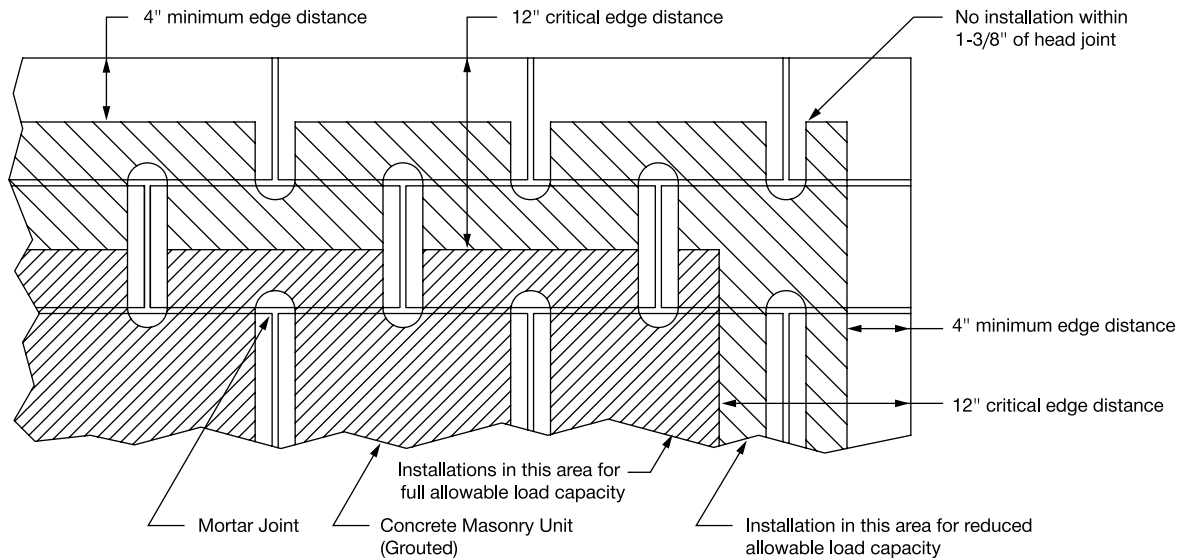
2 Loads tabulated are applicable to anchors spaced a critical distance of 4 times the embedment depth. The anchors may be placed at a minimum spacing, s_{min} , provided that reductions are applied to the tabulated values.

3 Anchors must be installed a minimum of 1-3/8 inches from any vertical mortar joint (head joint) in accordance with Figure 7.

4 Allowable loads or applied loads may be modified for the 2009 and 2006 IBC, due to short-term wind or seismic loads. See Table 47.

5 Embedment depth must be measured from the outside face of the concrete masonry unit.

6 For intermediate edge distances and spacings, allowable loads may be determined by linearly interpolating between the allowable loads at the two tabulated edge distances.

Figure 7 – Acceptable locations (shaded areas) for Hilti KWIK Bolt TZ anchors in grout-filled concrete masonry

Anchor installation is restricted to shaded areas

3.3.5

Table 47 - Alternative basic load combination adjustment factors under the 2009 or 2006 IBC^{1,2,3}

Modification factor for alternate basic load combinations		Modification factor for allowable loads for short-term loading conditions	
Tension	Shear	Tension	Shear
0.75	0.75	1.33	1.33

- 1 When using the basic load combinations in accordance with IBC Section 1605.3.1, allowable loads must not be increased for wind or seismic loading.
- 2 When using the alternative basic load combinations in the 2009 or 2006 IBC Section 1605.3.2 that include wind or seismic loads, the allowable loads for anchors may be increased by the tabulated factors found in the right half of the table. Alternatively, the basic load combinations may be reduced by multiplying them by the factors found on the left half of the table. For example, the alternate basic loads for wind or seismic loading may be multiplied by 0.75 or divided by 1.33, as applicable. For the 2015 and 2012 IBC, the allowable loads or load combinations must not be adjusted.
- 3 The above modification factors are applicable under the 2009 or 2006 IBC only, for Tables 45 and 46 for seismic and wind loads.

INSTALLATION INSTRUCTIONS

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

3.3.5.6 ORDERING INFORMATION¹

Description			Length	Threaded length	Box quantity
KB-TZ 3/8x3			3	1-1/2	50
	KB-TZ SS304 3/8x3	KB-TZ SS316 3/8x3	3	7/8	50
KB-TZ 3/8x3-3/4			3-3/4	2-1/4	50
	KB-TZ SS304 3/8x3-3/4	KB-TZ SS316 3/8x3-3/4	3-3/4	1-5/8	50
KB-TZ 3/8x5			5	3-1/2	50
	KB-TZ SS304 3/8x5		5	2-7/8	50
KB-TZ 1/2x3-3/4	KB-TZ SS304 1/2x3-3/4	KB-TZ SS316 1/2x3-3/4	3-3/4	1-5/8	20
KB-TZ 1/2x4-1/2	KB-TZ SS304 1/2x4-1/2	KB-TZ SS316 1/2x4-1/2	4-1/2	2-3/8	20
KB-TZ 1/2x5-1/2	KB-TZ SS304 1/2x5-1/2	KB-TZ SS316 1/2x5-1/2	5-1/2	3-3/8	20
KB-TZ 1/2x7	KB-TZ SS304 1/2x7		7	4-7/8	20
KB-TZ 5/8x4-3/4	KB-TZ SS304 5/8x4-3/4	KB-TZ SS316 5/8x4-3/4	4-3/4	1-1/2	15
KB-TZ 5/8x6	KB-TZ SS304 5/8x6	KB-TZ SS316 5/8x6	6	2-3/4	15
KB-TZ 5/8x8-1/2	KB-TZ SS304 5/8x8-1/2		8-1/2	5-1/4	15
KB-TZ 5/8x10	KB-TZ SS304 5/8x10		10	6-3/4	15
KB-TZ 3/4x5-1/2			5-1/2	2-1/2	10
	KB-TZ SS304 3/4x5-1/2	KB-TZ SS316 3/4x5-1/2	5-1/2	1-1/2	10
KB-TZ 3/4x7			7	4	10
KB-TZ 3/4x8			8	5	10
	KB-TZ SS304 3/4x8		8	4	10
KB-TZ 3/4x10			10	7	10
	KB-TZ SS304 3/4x10	KB-TZ SS316 3/4x10	10	6	10

¹ All dimensions in inches

Table 44 - KWIK Bolt TZ length identification system

Length ID marking on bolt head		A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W
Length of anchor, ℓ_{anch} in.	From	1 1/2	2	2 1/2	3	3 1/2	4	4 1/2	5	5 1/2	6	6 1/2	7	7 1/2	8	8 1/2	9	9 1/2	10	11	12	13	14	15
	Up to but not including	2	2 1/2	3	3 1/2	4	4 1/2	5	5 1/2	6	6 1/2	7	7 1/2	8	8 1/2	9	9 1/2	10	11	12	13	14	15	16

Figure 8 — Bolt head with length identification mark and KWIK Bolt TZ head notch embossment

