KB-TZ2 TECHNICAL GUIDE

Allowable stress design for use in components and structural supports in nuclear facilities

Allowable stress design information

The load tables in this section were developed for use in NQA projects utilizing allowable stress anchorage design when appropriate per their design basis. The load values were developed based on testing per ACI 355.2 and ASTM E488. Additional information, including complete details on this product, data development, product specifications, general suitability, installation, corrosion, ordering information, and spacing and edge distance guidelines, will be included in the North American Product Technical Guide: Volume 2: Anchor Fastening Technical Guide, Edition 21 (PTG 21).

Table 1A - Setting information

Setting information	Symbol	Units	Nominal anchor diameter (in)													
			1/4	3/8			1/2				5/8			3/4		
Nominal bit diameter	d_o	in.	1/4	3/8			1/2				5/8			3/4		
Effective min. embedment	h_{ef}	in.	1-1/2	1-1/2	2	2-1/2	1-1/2[1]	2	2-1/2	3-1/4	2-3/4	3-1/4	4	3-1/4	3-3/4	4-3/4
		(mm)	(38)	(38)	(51)	(64)	(38)	(51)	(64)	(83)	(70)	(83)	(102)	(83)	(95)	(121)
Nominal embedment	h_{nom}	in.	1-3/4	1-7/8	2-1/2	3	2[1]	2-1/2	3	3-3/4	3-1/4	3-3/4	4-1/2	4	4-1/2	5-1/2
		(mm)	(44)	(48)	(64)	(76)	(51)	(64)	(76)	(95)	(83)	)95)	)114)	(102)	(114)	(140)
Min. hole depth	h_o	in.	2	2	2-3/4	3-1/4	2-1/4[1]	2-3/4	3-1/4	4-1/4	3-3/4	4-1/4	4-3/4	4-1/4	4-3/4	5-3/4
		(mm)	(51)	(51)	(70)	(83)	(57)	(70)	(83)	(108)	(95)	(108)	(121)	(108)	(121)	(146)
Installation torque carbon steel[1]	T_{inst}	ft-lb	4	30			50				40			110		
		(Nm)	(5)	(41)			(68)				(54)			(149)		
Installation torque stainless steel[1]	T_{inst}	ft-lb	6	30			40				60			125		
		(Nm)	(8)	(41)			(54)				(81)			(169)		
Fixture hole diameter	d_h	in.	5/16	7/16			9/16				11/16			13/16		
		(mm)	(7.9)	(11.1)			(14.3)				(17.5)			(20.6)		

[1] Design information for h_{ef} = 1-1/2 is only applicable to carbon steel (CS) KB-TZ2 bolts.

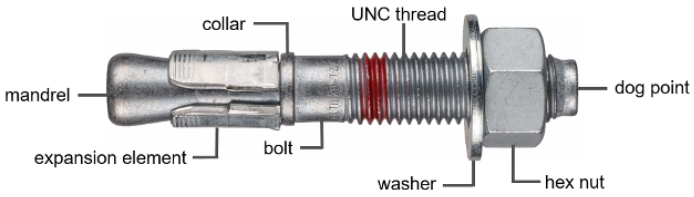

Figure 1 — Hilti carbon steel KWIK BOLT TZ2 (KB-TZ2)

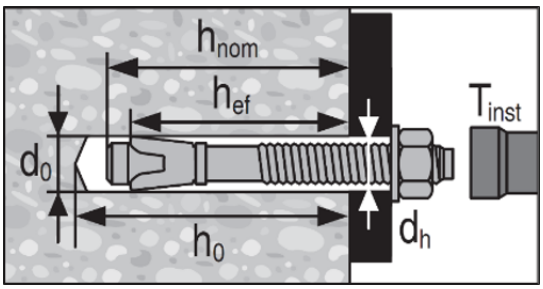

Figure 2 — Hilti KB-TZ2 installed

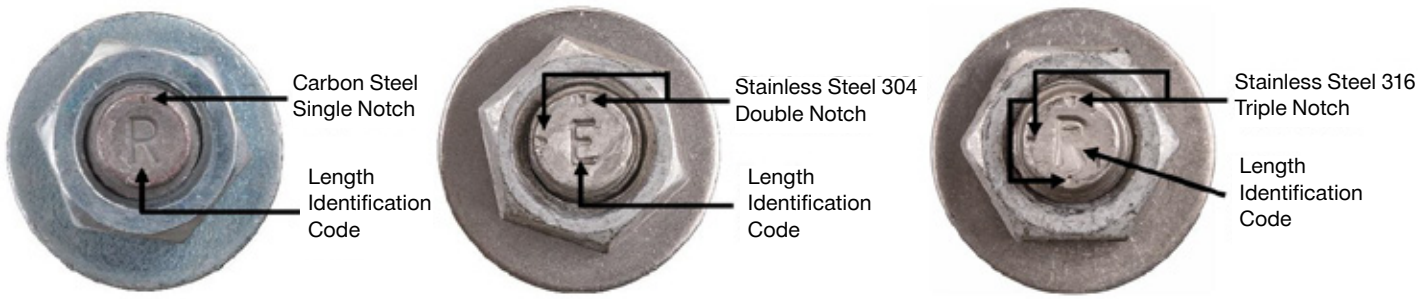

Figure 3 — Bolt head with length identification code and KB-TZ2 head notch embossment

Table 1B - Minimum edge distance, spacing and concrete thickness for KB-TZ2

Setting information	Symbol	Units	Nominal anchor diameter (in)													
			1/4	3/8			1/2				5/8			3/4		
Effective min. embedment	h_{ef}	in.	1-1/2	1-1/2	2	2-1/2	1-1/2	2	2-1/2	3-1/4	2-3/4	3-1/4	4	3-1/4	3-3/4	4-3/4
		(mm)	(38)	(38)	(51)	(64)	(38)	(51)	(64)	(83)	(70)	(83)	(102)	(83)	(95)	(121)
Min. member thickness	h_{min}	in.	3-1/4	3-1/4	4	5	3-1/2	4	5	5-1/2	5	5-1/2	6	5-1/2	6	8
		(mm)	(83)	(83)	(102)	(127)	(89)	(102)	(127)	(140)	(127)	(140)	(152)	(140)	(152)	(203)
Carbon steel																
Min. edge distance	c_{min}	in.	1-1/2	5	2-1/2	2-1/2	8	2-3/4	2-3/4	2-1/4	4-1/2	3-1/2	2-3/4	5	4	3-1/2
		(mm)	(38)	(127)	(64)	(64)	(203)	(70)	(70)	(57)	(114)	(89)	(70)	(127)	(102)	(89)
	for s ≥	in.	1-1/2	8	6	5	12	5-1/2	9-3/4	5-1/4	6-1/2	5-1/2	7-1/4	10	5-3/4	5-1/2
		(mm)	(38)	(203)	(152)	(127)	(305)	(140)	(248)	(133)	(165)	(140)	(184)	(254)	(146)	(140)
Min. anchor spacing	s_{min}	in.	1-1/2	5	2-1/4	2	12	3-1/2	3	2	4-1/2	2-3/4	2-1/4	4-1/2	3-3/4	3-3/4
		(mm)	(38)	(127)	(57)	(51)	(305)	(89)	(76)	(51)	(114)	(70)	(57)	(114)	(95)	(95)
	for c ≥	In.	1-1/2	8	3-1/2	4	8	10	8	4-3/4	5-1/2	7	4-1/4	6	7-1/2	4-3/4
		(mm)	(38)	(203)	(89)	(102)	(203)	(254)	(203)	(121)	(140)	(178)	(108)	(152)	(191)	(121)
Stainless steel																
Min. edge distance	c_{min}	in.	1-1/2	5	2-1/2	2-1/2		2-3/4	2-1/2	2-1/4	4	3-1/4	2-1/4	5	4	3-3/4
		(mm)	(38)	(127)	(64)	(64)		(70)	(64)	(57)	(102)	(83)	(57)	(127)	(102)	(95)
	for s ≥	in.	1-1/2	8	5	5		5-1/2	4-1/2	5-1/4	7	5-1/2	7	11	7-1/2	5-3/4
		(mm)	(38)	(203)	(127)	(127)		(140)	(114)	(133)	(178)	(140)	(178)	(279)	(191)	(146)
Min. anchor spacing	s_{min}	in.	1-1/2	5	2-1/4	2-1/4		2-3/4	2-1/2	2	5-1/2	2-3/4	3	5	4	4
		(mm)	(38)	(127)	(57)	(57)		(70)	(64)	(51)	(140)	(70)	(76)	(127)	(102)	(102)
	for c ≥	In.	1-1/2	8	4	3-1/2		4-1/8	5	4-3/4	5-1/2	4	4-1/4	8	6	5-1/4
		(mm)	(38)	(203)	(102)	(89)		(105)	(127)	(121)	(140)	(102)	(108)	(203)	(152)	(133)

For **SI**: 1 inch = 25.4 mm

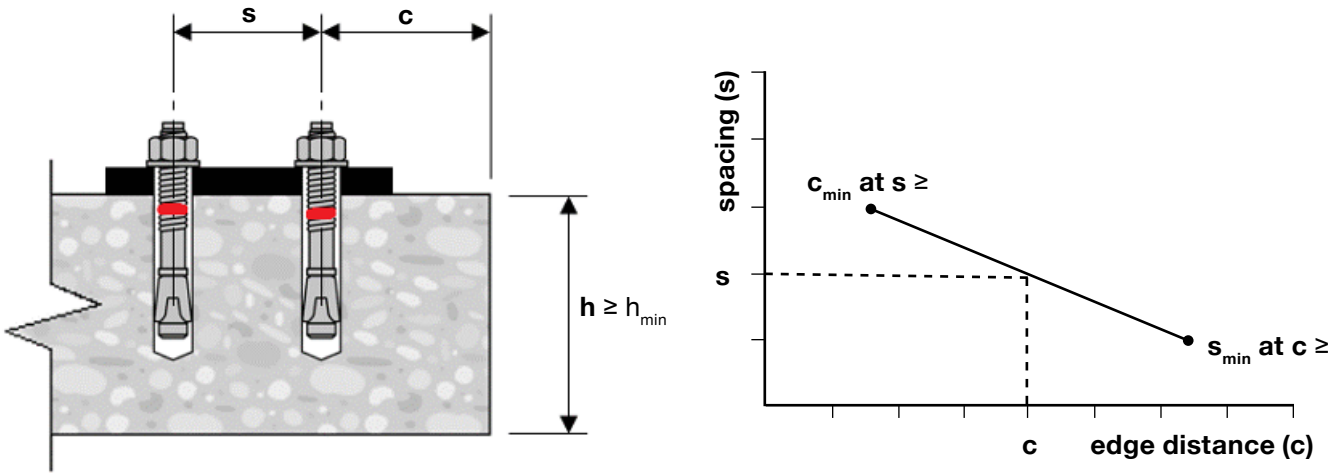

Figure 4 — Interpolation of minimum edge distance and anchor spacing

Table 3 - Ultimate Hilti carbon steel KB-TZ2 strength in uncracked concrete for hammer drill and core drill installations[1]

Nominal anchor diameter in.	Effective embedment in. (mm)	Nominal embedment in. (mm)	Tension				Shear	
			f'_c = 3000 psi (20.7 MPa) lb (kN)	f'_c = 4000 psi (27.6 MPa) lb (kN)	f'_c = 5000 psi (34.5 MPa) lb (kN)	f'_c = 6000 psi (41.4 MPa) lb (kN)	f'_c = 3000 psi (20.7 MPa) lb (kN)	f'_c ≥ 4000 psi (27.6 MPa) lb (kN)
1/4	1-1/2 (38)	1-3/4 (44)	2,421 (10.8)	2,565 (11.4)	2,683 (11.9)	2,783 (12.4)	1,585 (7.1)	1,652 (7.3)
3/8	1-1/2 (38)	1-7/8 (48)	3,600 (16.0)	3,837 (17.1)	4,032 (17.9)	4,198 (18.7)	3,744 (16.7)	
	2 (51)	2-1/2 (64)	4,830 (21.5)	5,173 (23.0)	5,455 (24.3)	5,698 (25.3)	3,744 (16.7)	
	2-1/2 (64)	3 (76)	5,557 (24.7)	6,153 (27.4)	6,658 (29.6)	7,102 (31.6)	3,744 (16.7)	
1/2	1-1/2 (38)	2 (51)	3,600 (16.0)	4,370 (19.4)	5,079 (22.6)	5,743 (25.5)	6,707 (29.8)	7,577 (33.7)
	2 (51)	2-1/2 (64)	5,611 (25.0)	6,328 (28.2)	6,948 (30.9)	7,498 (33.4)	6,707 (29.8)	7,577 (33.7)
	2-1/2 (64)	3 (76)	7,117 (31.7)	7,735 (34.4)	8,251 (36.7)	8,698 (38.7)	6,707 (29.8)	7,577 (33.7)
	3-1/4 (83)	3-3/4 (95)	9,177 (40.8)	10,148 (45.1)	10,972 (48.8)	11,695 (52.0)	6,707 (29.8)	7,577 (33.7)
5/8	2-3/4 (70)	3-1/4 (83)	7,246 (32.2)	8,505 (37.8)	9,631 (42.8)	10,661 (47.4)	11,650 (51.8)	
	3-1/4 (83)	3-3/4 (95)	10,319 (45.9)	11,854 (52.7)	13,199 (58.7)	14,411 (64.1)	11,650 (51.8)	
	4 (102)	4-1/2 (114)	10,795 (48.0)	12,625 (56.2)	14,257 (63.4)	15,745 (70.0)	11,650 (51.8)	
3/4	3-1/4 (83)	4 (102)	12,014 (53.4)	13,279 (59.1)	14,352 (63.8)	15,292 (68.0)	15,120 (67.3)	
	3-3/4 (95)	4-1/2 (114)	15,639 (69.6)	17,088 (76.0)	18,304 (81.4)	19,362 (86.1)	15,120 (67.3)	
	4-3/4 (121)	5-1/2 (140)	17,914 (79.7)	20,067 (89.3)	21,914 (97.5)	23,548 (104.7)	15,120 (67.3)	

[1] Testing performed in accordance with ACI 355.2 and ASTM E488.1

Table 4 - Allowable Hilti carbon steel KB-TZ2 strength in uncracked concrete for hammer drill and core drill installations[1,2,3,4]

Nominal anchor diameter in.	Effective embedment in. (mm)	Nominal embedment in. (mm)	Tension				Shear	
			f'_c = 3000 psi (20.7 MPa) lb (kN)	f'_c = 4000 psi (27.6 MPa) lb (kN)	f'_c = 5000 psi (34.5 MPa) lb (kN)	f'_c = 6000 psi (41.4 MPa) lb (kN)	f'_c = 3000 psi (20.7 MPa) lb (kN)	f'_c ≥ 4000 psi (27.6 MPa) lb (kN)
1/4	1-1/2 (38)	1-3/4 (44)	605 (2.7)	641 (2.9)	671 (3.0)	696 (3.1)	396 (1.8)	413 (1.8)
3/8	1-1/2 (38)	1-7/8 (48)	900 (4.0)	959 (4.3)	1,008 (4.5)	1,050 (4.7)	936 (4.2)	
	2 (51)	2-1/2 (64)	1,208 (5.4)	1,293 (5.8)	1,364 (6.1)	1,424 (6.3)	936 (4.2)	
	2-1/2 (64)	3 (76)	1,389 (6.2)	1,538 (6.8)	1,665 (7.4)	1,776 (7.9)	936 (4.2)	
1/2	1-1/2 (38)	2 (51)	900 (4.0)	1,092 (4.9)	1,270 (5.6)	1,436 (6.4)	1,677 (7.5)	1,894 (8.4)
	2 (51)	2-1/2 (64)	1,403 (6.2)	1,582 (7.0)	1,737 (7.7)	1,875 (8.3)	1,677 (7.5)	1,894 (8.4)
	2-1/2 (64)	3 (76)	1,779 (7.9)	1,934 (8.6)	2,063 (9.2)	2,175 (9.7)	1,677 (7.5)	1,894 (8.4)
	3-1/4 (83)	3-3/4 (95)	2,294 (10.2)	2,537 (11.3)	2,743 (12.2)	2,924 (13.0)	1,677 (7.5)	1,894 (8.4)
5/8	2-3/4 (70)	3-1/4 (83)	1,811 (8.1)	2,126 (9.5)	2,408 (10.7)	2,665 (11.9)	2,913 (13.0)	
	3-1/4 (83)	3-3/4 (95)	2,580 (11.5)	2,963 (13.2)	3,300 (14.7)	3,603 (16.0)	2,913 (13.0)	
	4 (102)	4-1/2 (114)	2,699 (12.0)	3,156 (14.0)	3,564 (15.9)	3,936 (17.5)	2,913 (13.0)	
3/4	3-1/4 (83)	4 (102)	3,003 (13.4)	3,320 (14.8)	3,588 (16.0)	3,823 (17.0)	3,780 (16.8)	
	3-3/4 (95)	4-1/2 (114)	3,910 (17.4)	4,272 (19.0)	4,576 (20.4)	4,841 (21.5)	3,780 (16.8)	
	4-3/4 (121)	5-1/2 (140)	4,479 (19.9)	5,017 (22.3)	5,478 (24.4)	5,887 (26.2)	3,780 (16.8)	

[1] Intermediate load values for other concrete strength and embedments can be calculated by linear interpolation

[2] Allowable load calculated using a factor of safety of 4.

[3] Apply spacing, edge distance, and concrete thickness factors in tables 7 to 11 as necessary.

[4] With the exception of 3/4" diameter KB-TZ2 strength, all of the load values in this table can be utilized for either hammer or core drilled installations. Refer to Tables 5 and 6 for 3/4" diameter core strength loads.

Table 5 - Ultimate Hilti carbon steel KB-TZ2 strength in uncracked concrete for core drill installations[1]

Nominal anchor diameter in.	Effective embedment in. (mm)	Nominal embedment in. (mm)	Tension				Shear	
			f'_c = 3000 psi (20.7 MPa) lb (kN)	f'_c = 4000 psi (27.6 MPa) lb (kN)	f'_c = 5000 psi (34.5 MPa) lb (kN)	f'_c = 6000 psi (41.4 MPa) lb (kN)	f'_c = 3000 psi (20.7 MPa) lb (kN)	$f'_c \geq$ 4000 psi (27.6 MPa) lb (kN)
3/4	3-1/4 (83)	4 (102)	9,826 (43.7)	10,841 (48.2)	12,661 (56.3)	14,280 (63.5)	15,120 (67.3)	
	3-3/4 (95)	4-1/2 (114)	11,544 (51.3)	12,850 (57.2)	15,220 (67.7)	17,354 (77.2)	15,120 (67.3)	
	4-3/4 (121)	5-1/2 (140)	16,492 (73.4)	18,210 (81.0)	21,290 (94.7)	23,548 (104.7)	15,120 (67.3)	

[1] Testing performed in accordance with ACI 355.2 and ASTM E488.

Table 6 - Allowable Hilti carbon steel KB-TZ2 strength in uncracked concrete for core drill installations[1,2,3]

Nominal anchor diameter in.	Effective embedment in. (mm)	Nominal embedment in. (mm)	Tension				Shear	
			f'_c = 3000 psi (20.7 MPa) lb (kN)	f'_c = 4000 psi (27.6 MPa) lb (kN)	f'_c = 5000 psi (34.5 MPa) lb (kN)	f'_c = 6000 psi (41.4 MPa) lb (kN)	f'_c = 3000 psi (20.7 MPa) lb (kN)	$f'_c \geq$ 4000 psi (27.6 MPa) lb (kN)
3/4	3-1/4 (83)	4 (102)	2,456 (10.9)	2,710 (12.1)	3,165 (14.1)	3,570 (15.9)	3,780 (16.8)	
	3-3/4 (95)	4-1/2 (114)	2,886 (12.8)	3,213 (14.3)	3,805 (16.9)	4,339 (19.3)	3,780 (16.8)	
	4-3/4 (121)	5-1/2 (140)	4,123 (18.3)	4,552 (20.2)	5,323 (23.7)	5,887 (26.2)	3,780 (16.8)	

[1] Intermediate load values for other concrete strength and embedments can be calculated by linear interpolation

[2] Allowable load calculated using a factor of safety of 4.

[3] Apply spacing, edge distance, and concrete thickness factors in tables 7 to 11 as necessary.

Table 7 - Load adjustment factors for carbon steel 1/4-in. diameter KB-TZ2 in uncracked concrete[1]

1/4-in. KB-TZ2 uncracked concrete			Spacing factor in tension f_{AN}	Edge distance factor in tension f_{RN}	Spacing factor in shear[2] f_{AV}	Edge distance in shear		Concrete thickness factor in shear[3] f_{HV}
						⊥ Toward edge f_{RV}	∥ To edge f_{RV}	
Effective embedment h_{ef}		in. (mm)	1-1/2 (38)	1-1/2 (38)	1-1/2 (38)	1-1/2 (38)	1-1/2 (38)	1-1/2 (38)
Nominal embedment h_{nom}		in. (mm)	1-3/4 (44)	1-3/4 (44)	1-3/4 (44)	1-3/4 (44)	1-3/4 (44)	1-3/4 (44)
Spacing (s) / Edge Distance (c_a) / Concrete Thickness (h) in. (mm)	1-1/2	(38)	0.67	0.42	0.56	0.23	0.42	n/a
	2	(51)	0.72	0.51	0.58	0.35	0.51	n/a
	2-1/2	(64)	0.78	0.63	0.60	0.49	0.63	n/a
	3	(76)	0.83	0.75	0.63	0.65	0.75	n/a
	3-1/4	(83)	0.86	0.81	0.64	0.73	0.81	0.74
	3-1/2	(89)	0.89	0.88	0.65	0.82	0.88	0.76
	4	(102)	0.94	1.00	0.67	1.00	1.00	0.82
	5	(127)	1.00		0.71			0.91
	6	(152)			0.75			1.00
	7	(178)			0.79			
	8	(203)			0.83			
	9	(229)			0.88			
	> 12	(305)			1.00			

[1] Linear interpolation not permitted

[2] Spacing factor reduction in shear, f_{AV}, is applicable when edge distance $c < 3h_{ef}$. If $c \geq 3h_{ef}$ then $f_{AV} = f_{AN}$.

[3] Concrete thickness reduction factor in shear, f_{HV}, is applicable when edge distance $c < 3h_{ef}$. If $c \geq 3h_{ef}$ then $f_{HV} = 1.0$.

Table 8 - Load adjustment factors for carbon steel 3/8-in. diameter KB-TZ2 in uncracked concrete[1]

3/8-in. KB-TZ2 uncracked concrete			Spacing factor in tension f_{AN}			Edge distance factor in tension f_{RN}			Spacing factor in shear[2] f_{AV}			Edge distance in shear						Concrete thickness factor in shear[3] f_{HV}		
												⊥ Toward edge			∥ To edge					
Effective embedment h_{ef}		in. (mm)	1-1/2 (38)	2 (51)	2-1/2 (64)	1-1/2 (38)	2 (51)	2-1/2 (64)	1-1/2 (38)	2 (51)	2-1/2 (64)	1-1/2 (38)	2 (51)	2-1/2 (64)	1-1/2 (38)	2 (51)	2-1/2 (64)	1-1/2 (38)	2 (51)	2-1/2 (64)
Nominal embedment h_{nom}		in. (mm)	1-7/8 (48)	2-1/2 (64)	3 (76)	1-7/8 (48)	2-1/2 (64)	3 (76)	1-7/8 (48)	2-1/2 (64)	3 (76)	1-7/8 (48)	2-1/2 (64)	3 (76)	1-7/8 (48)	2-1/2 (64)	3 (76)	1-7/8 (48)	2-1/2 (64)	3 (76)
Spacing (s) / Edge Distance (c_a) / Concrete Thickness (h) in. (mm)	2	(51)	n/a	n/a	0.63	n/a	n/a	n/a	n/a	n/a	0.54	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	2-1/4	(57)	n/a	0.69	0.65	n/a	n/a	n/a	n/a	0.59	0.55	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	2-1/2	(64)	n/a	0.71	0.67	n/a	0.60	0.51	n/a	0.60	0.55	n/a	0.43	0.18	n/a	0.60	0.37	n/a	n/a	n/a
	3	(76)	n/a	0.75	0.70	n/a	0.69	0.58	n/a	0.61	0.56	n/a	0.57	0.24	n/a	0.69	0.48	n/a	n/a	n/a
	3-1/4	(83)	n/a	0.77	0.72	n/a	0.74	0.61	n/a	0.62	0.57	n/a	0.64	0.27	n/a	0.74	0.54	0.66	n/a	n/a
	3-1/2	(89)	n/a	0.79	0.73	n/a	0.80	0.65	n/a	0.63	0.58	n/a	0.72	0.30	n/a	0.80	0.61	0.68	n/a	n/a
	4	(102)	n/a	0.83	0.77	n/a	0.91	0.73	n/a	0.65	0.59	n/a	0.87	0.37	n/a	0.91	0.73	0.73	0.78	n/a
	5	(127)	1.00	0.92	0.83	1.00	1.00	0.91	0.67	0.69	0.61	1.00	1.00	0.52	1.00	1.00	0.91	0.82	0.87	0.66
	6	(152)	1.00	1.00	0.90	1.00		1.00	0.70	0.73	0.63	1.00		0.68	1.00		1.00	0.89	0.96	0.72
	8	(203)	1.00		1.00	1.00			0.77	0.80	0.67	1.00		1.00	1.00			1.00	1.00	0.83
	12	(305)							0.90	0.96	0.76									1.00
	18	(457)							1.00	1.00	0.89									
	> 24	(610)									1.00									

[1] Linear interpolation not permitted

[2] Spacing factor reduction in shear, f_{AV}, is applicable when edge distance $c < 3h_{ef}$. If $c \geq 3h_{ef}$ then $f_{AV} = f_{AN}$.

[3] Concrete thickness reduction factor in shear, f_{HV}, is applicable when edge distance $c < 3h_{ef}$. If $c \geq 3h_{ef}$ 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). Refer to the North American Product Technical Guide: Volume 2: Anchor Fastening Technical Guide, Edition 21 (PTG 21) for more information.

Table 9 - Load adjustment factors for carbon steel 1/2-in. diameter KB-TZ2 in uncracked concrete[1]

1/2-in. KB-TZ2 uncracked concrete			Spacing factor in tension f_{AN}				Edge distance factor in tension f_{RN}				Spacing factor in shear[2] f_{AV}				Edge distance in shear								Conc. thickness factor in shear[3] f_{HV}			
															⊥ Toward edge				∥ To edge							
Effective embedment h_{ef}		in. (mm)	1-1/2 (38)	2 (51)	2-1/2 (64)	3-1/4 (83)	1-1/2 (38)	2 (51)	2-1/2 (64)	3-1/4 (83)	1-1/2 (38)	2 (51)	2-1/2 (64)	3-1/4 (83)	1-1/2 (38)	2 (51)	2-1/2 (64)	3-1/4 (83)	1-1/2 (38)	2 (51)	2-1/2 (64)	3-1/4 (83)	1-1/2 (38)	2 (51)	2-1/2 (64)	3-1/4 (83)
Nominal embedment h_{nom}		in. (mm)	2 (51)	2-1/2 (64)	3 (76)	3-3/4 (95)	2 (51)	2-1/2 (64)	3 (76)	3-3/4 (95)	2 (51)	2-1/2 (64)	3 (76)	3-3/4 (95)	2 (51)	2-1/2 (64)	3 (76)	3-3/4 (95)	2 (51)	2-1/2 (64)	3 (76)	3-3/4 (95)	2 (51)	2-1/2 (64)	3 (76)	3-3/4 (95)
Spacing (s) / Edge Distance (c_a) / Concrete Thickness (h) in. (mm)	2	(51)	n/a	n/a	n/a	0.60	n/a	n/a	n/a	n/a	n/a	n/a	n/a	0.53	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	2-1/4	(57)	n/a	n/a	n/a	0.62	n/a	n/a	n/a	0.30	n/a	n/a	n/a	0.54	n/a	n/a	n/a	0.11	n/a	n/a	n/a	0.21	n/a	n/a	n/a	n/a
	2-3/4	(70)	n/a	n/a	n/a	0.64	n/a	0.51	0.44	0.33	n/a	n/a	n/a	0.55	n/a	0.35	0.23	0.14	n/a	0.51	0.44	0.29	n/a	n/a	n/a	n/a
	3	(76)	n/a	n/a	0.70	0.65	n/a	0.55	0.47	0.35	n/a	n/a	0.57	0.55	n/a	0.40	0.26	0.16	n/a	0.55	0.47	0.33	n/a	n/a	n/a	n/a
	3-1/4	(83)	n/a	n/a	0.72	0.67	n/a	0.59	0.50	0.37	n/a	n/a	0.57	0.55	n/a	0.45	0.30	0.19	n/a	0.59	0.50	0.37	0.52	n/a	n/a	n/a
	3-1/2	(89)	n/a	0.79	0.73	0.68	n/a	0.64	0.53	0.38	n/a	0.61	0.58	0.56	n/a	0.51	0.33	0.21	n/a	0.64	0.53	0.38	0.54	n/a	n/a	n/a
	4	(102)	n/a	0.83	0.77	0.71	n/a	0.73	0.59	0.42	n/a	0.62	0.59	0.57	n/a	0.62	0.40	0.25	n/a	0.73	0.59	0.42	0.58	0.70	n/a	n/a
	4-3/4	(121)	n/a	0.90	0.82	0.74	n/a	0.86	0.70	0.48	n/a	0.64	0.61	0.58	n/a	0.80	0.52	0.33	n/a	0.86	0.70	0.48	0.63	0.76	n/a	n/a
	5	(127)	n/a	0.92	0.83	0.76	n/a	0.91	0.74	0.50	n/a	0.65	0.61	0.58	n/a	0.87	0.56	0.35	n/a	0.91	0.74	0.50	0.65	0.78	0.67	n/a
	5-1/4	(133)	n/a	0.94	0.85	0.77	n/a	0.95	0.78	0.53	n/a	0.66	0.62	0.59	n/a	0.93	0.61	0.38	n/a	0.95	0.78	0.53	0.66	0.80	0.69	n/a
	5-1/2	(140)	n/a	0.96	0.87	0.78	n/a	1.00	0.81	0.55	n/a	0.67	0.63	0.59	n/a	1.00	0.65	0.41	n/a	1.00	0.81	0.55	0.68	0.82	0.71	0.61
	6	(152)	n/a	1.00	0.90	0.81	n/a	1.00	0.89	0.60	n/a	0.68	0.64	0.60	n/a	1.00	0.74	0.46	n/a	1.00	0.89	0.60	0.71	0.85	0.74	0.63
	8	(203)	n/a		1.00	0.91	1.00	1.00	1.00	0.80	n/a	0.74	0.68	0.63	1.00	1.00	1.00	0.72	1.00	1.00	1.00	0.80	0.82	0.98	0.85	0.73
	9-3/4	(248)	n/a		1.00	1.00		1.00		0.98	n/a	0.80	0.72	0.66		1.00		0.96		1.00		0.98	0.90	1.00	0.94	0.81
	10	(254)	n/a					1.00		1.00	n/a	0.80	0.73	0.67		1.00		1.00		1.00		1.00	0.91		0.95	0.82
	12	(305)	1.00								0.75	0.86	0.77	0.70									1.00		1.00	0.89
	24	(610)									1.00	1.00	1.00	0.90												1.00
	> 30	(762)												1.00												

[1] Linear interpolation not permitted

[2] Spacing factor reduction in shear, f_{AV}, is applicable when edge distance $c < 3h_{ef}$. If $c \geq 3h_{ef}$ then $f_{AV} = f_{AN}$.

[3] Concrete thickness reduction factor in shear, f_{HV}, is applicable when edge distance $c < 3h_{ef}$. If $c \geq 3h_{ef}$ 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). Refer to the North American Product Technical Guide: Volume 2: Anchor Fastening Technical Guide, Edition 21 (PTG 21) for more information.

Table 10 - Load adjustment factors for carbon steel 5/8-in. diameter KB-TZ2 in uncracked concrete[1]

5/8-in. KB-TZ2 uncracked concrete			Spacing factor in tension f_{AN}			Edge distance factor in tension f_{RN}			Spacing factor in shear[2] f_{AV}			Edge distance in shear						Concrete thickness factor in shear[3] f_{HV}		
												⊥ Toward edge			∥ To edge					
Effective embedment h_{ef}		in. (mm)	2-3/4 (70)	3-1/4 (83)	4 (102)	2-3/4 (70)	3-1/4 (83)	4 (102)	2-3/4 (70)	3-1/4 (83)	4 (102)	2-3/4 (70)	3-1/4 (83)	4 (102)	2-3/4 (70)	3-1/4 (83)	4 (102)	2-3/4 (70)	3-1/4 (83)	4 (102)
Nominal embedment h_{nom}		in. (mm)	3-1/4 (83)	3-3/4 (95)	4-1/2 (114)	3-1/4 (83)	3-3/4 (95)	4-1/2 (114)	3-1/4 (83)	3-3/4 (95)	4-1/2 (114)	3-1/4 (83)	3-3/4 (95)	4-1/2 (114)	3-1/4 (83)	3-3/4 (95)	4-1/2 (114)	3-1/4 (83)	3-3/4 (95)	4-1/2 (114)
Spacing (s) / Edge Distance (c_a) / Concrete Thickness (h) in. (mm)	2-1/4	(57)	n/a	0.62	n/a	n/a	n/a	0.38	n/a	0.53	n/a	n/a	n/a	0.10	n/a	n/a	0.20	n/a	n/a	n/a
	2-3/4	(70)	n/a	0.64	0.61	n/a	n/a	0.42	n/a	0.54	0.54	n/a	n/a	0.13	n/a	n/a	0.27	n/a	n/a	n/a
	3	(76)	n/a	0.65	0.63	n/a	0.30	0.44	n/a	0.54	0.55	n/a	0.13	0.15	n/a	0.27	0.30	n/a	n/a	n/a
	3-1/2	(89)	n/a	0.68	0.65	n/a	0.33	0.48	n/a	0.55	0.56	n/a	0.17	0.19	n/a	0.33	0.38	n/a	n/a	n/a
	4	(102)	0.74	0.71	0.67	0.40	0.37	0.51	0.57	0.56	0.56	0.25	0.21	0.23	0.40	0.37	0.47	n/a	n/a	n/a
	4-1/2	(114)	0.77	0.73	0.69	0.45	0.40	0.56	0.58	0.57	0.57	0.30	0.24	0.28	0.45	0.40	0.56	n/a	n/a	n/a
	5	(127)	0.80	0.76	0.71	0.50	0.43	0.60	0.58	0.57	0.58	0.35	0.29	0.33	0.50	0.43	0.60	0.58	n/a	n/a
	5-1/2	(140)	0.83	0.78	0.73	0.55	0.48	0.64	0.59	0.58	0.59	0.41	0.33	0.38	0.55	0.48	0.64	0.61	0.56	n/a
	6	(152)	0.86	0.81	0.75	0.60	0.52	0.69	0.60	0.59	0.59	0.46	0.38	0.43	0.60	0.52	0.69	0.63	0.59	0.62
	6-1/2	(165)	0.89	0.83	0.77	0.65	0.57	0.74	0.61	0.59	0.60	0.52	0.42	0.48	0.65	0.57	0.74	0.66	0.61	0.64
	7	(178)	0.92	0.86	0.79	0.70	0.61	0.80	0.62	0.60	0.61	0.59	0.47	0.54	0.70	0.61	0.80	0.68	0.64	0.67
	7-1/4	(184)	0.94	0.87	0.80	0.73	0.63	0.83	0.62	0.61	0.61	0.62	0.50	0.57	0.73	0.63	0.83	0.70	0.65	0.68
	12	(305)	1.00	1.00	1.00	1.00	1.00	1.00	0.70	0.67	0.69	1.00	1.00	1.00	1.00	1.00	1.00	0.89	0.83	0.87
	24	(610)							0.90	0.85	0.88							1.00	1.00	1.00
	> 36	(914)							1.00	1.00	1.00									

[1] Linear interpolation not permitted

[2] Spacing factor reduction in shear, f_{AV}, is applicable when edge distance $c < 3h_{ef}$. If $c \geq 3h_{ef}$ then $f_{AV} = f_{AN}$.

[3] Concrete thickness reduction factor in shear, f_{HV}, is applicable when edge distance $c < 3h_{ef}$. If $c \geq 3h_{ef}$ 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). Refer to the North American Product Technical Guide: Volume 2: Anchor Fastening Technical Guide, Edition 21 (PTG 21) for more information.

Table 11 - Load adjustment factors for carbon steel 3/4-in. diameter KB-TZ2 in uncracked concrete[1]

3/4-in. KB-TZ2 uncracked concrete			Spacing factor in tension f_{AN}			Edge distance factor in tension f_{RN}			Spacing factor in shear[2] f_{AV}			Edge distance in shear						Concrete thickness factor in shear[3] f_{HV}		
												⊥ Toward edge			∥ To edge					
Effective embedment 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 embedment h_{nom}		in. (mm)	4 (102)	4-1/2 (114)	5-1/2 (140)	4 (102)	4-1/2 (114)	5-1/2 (140)	4 (102)	4-1/2 (114)	5-1/2 (140)	4 (102)	4-1/2 (114)	5-1/2 (140)	4 (102)	4-1/2 (114)	5-1/2 (140)	4 (102)	4-1/2 (114)	5-1/2 (140)
Spacing (s) / Edge Distance (c_a) / Concrete Thickness (h) in. (mm)	3-1/2	(89)	n/a	n/a	n/a	n/a	n/a	0.50	n/a	n/a	n/a	n/a	n/a	0.16	n/a	n/a	0.32	n/a	n/a	n/a
	3-3/4	(95)	n/a	0.67	0.63	n/a	n/a	0.52	n/a	0.56	0.55	n/a	n/a	0.18	n/a	n/a	0.36	n/a	n/a	n/a
	4	(102)	n/a	0.68	0.64	n/a	0.44	0.54	n/a	0.56	0.56	n/a	0.24	0.20	n/a	0.44	0.40	n/a	n/a	n/a
	4-1/2	(114)	0.73	0.70	0.66	n/a	0.48	0.57	0.56	0.57	0.56	n/a	0.29	0.24	n/a	0.48	0.47	n/a	n/a	n/a
	4-3/4	(121)	0.74	0.71	0.67	n/a	0.49	0.59	0.57	0.58	0.57	n/a	0.31	0.26	n/a	0.49	0.51	n/a	n/a	n/a
	5	(127)	0.76	0.72	0.68	0.42	0.51	0.61	0.57	0.58	0.57	0.27	0.33	0.28	0.42	0.51	0.55	n/a	n/a	n/a
	5-1/2	(140)	0.78	0.74	0.69	0.46	0.55	0.65	0.58	0.59	0.58	0.31	0.39	0.32	0.46	0.55	0.64	0.55	n/a	n/a
	5-3/4	(146)	0.79	0.76	0.70	0.48	0.58	0.67	0.58	0.59	0.58	0.33	0.41	0.34	0.48	0.58	0.67	0.57	n/a	n/a
	6	(152)	0.81	0.77	0.71	0.50	0.60	0.69	0.58	0.60	0.58	0.35	0.44	0.36	0.50	0.60	0.69	0.58	0.62	n/a
	7	(178)	0.86	0.81	0.75	0.58	0.70	0.78	0.60	0.61	0.60	0.45	0.55	0.46	0.58	0.70	0.78	0.62	0.67	n/a
	7-1/2	(191)	0.88	0.83	0.76	0.63	0.75	0.83	0.60	0.62	0.61	0.49	0.61	0.51	0.63	0.75	0.83	0.65	0.69	n/a
	8	(203)	0.91	0.86	0.78	0.67	0.80	0.89	0.61	0.63	0.61	0.54	0.68	0.56	0.67	0.80	0.89	0.67	0.72	0.67
	9	(229)	0.96	0.90	0.82	0.75	0.90	1.00	0.63	0.64	0.63	0.65	0.81	0.67	0.75	0.90	1.00	0.71	0.76	0.71
	10	(254)	1.00	0.94	0.85	0.83	1.00		0.64	0.66	0.64	0.76	0.94	0.78	0.83	1.00		0.75	0.80	0.75
	11	(279)		0.99	0.89	0.92			0.65	0.68	0.66	0.88	1.00	0.90	0.92			0.78	0.84	0.79
	12	(305)		1.00	0.92	1.00			0.67	0.69	0.67	1.00		1.00	1.00			0.82	0.88	0.82
	16	(406)			1.00				0.72	0.76	0.73							0.94	1.00	0.95
	18	(457)							0.75	0.79	0.75							1.00		1.00
	24	(610)							0.83	0.89	0.84									
	> 36	(914)							1.00	1.00	1.00									

[1] Linear interpolation not permitted

[2] Spacing factor reduction in shear, f_{AV}, is applicable when edge distance $c < 3h_{ef}$. If $c \geq 3h_{ef}$ then $f_{AV} = f_{AN}$.

[3] Concrete thickness reduction factor in shear, f_{HV}, is applicable when edge distance $c < 3h_{ef}$. If $c \geq 3h_{ef}$ 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). Refer to the North American Product Technical Guide: Volume 2: Anchor Fastening Technical Guide, Edition 21 (PTG 21) for more information.

Table 12 - Ultimate Hilti stainless steel KB-TZ2 strength in uncracked concrete for hammer drill and core drill installations[1]

Nominal anchor diameter in.	Effective embedment in. (mm)	Nominal embedment in. (mm)	Tension				Shear	
			f'_c = 3000 psi (20.7 MPa) lb (kN)	f'_c = 4000 psi (27.6 MPa) lb (kN)	f'_c = 5000 psi (34.5 MPa) lb (kN)	f'_c = 6000 psi (41.4 MPa) lb (kN)	f'_c = 3000 psi (20.7 MPa) lb (kN)	f'_c ≥ 4000 psi (27.6 MPa) lb (kN)
1/4	1-1/2 (38)	1-3/4 (44)	2,098 (9.3)	2,344 (10.4)	2,555 (11.4)	2,741 (12.2)	2,203 (9.8)	
3/8	1-1/2 (38)	1-7/8 (48)	2,959 (13.2)	3,597 (16.0)	4,186 (18.6)	4,737 (21.1)	5,006 (22.3)	5,377 (23.9)
	2 (51)	2-1/2 (64)	4,923 (21.9)	5,675 (25.2)	6,337 (28.2)	6,935 (30.8)	5,006 (22.3)	5,377 (23.9)
	2-1/2 (64)	3 (76)	5,269 (23.4)	5,862 (26.1)	6,368 (28.3)	6,813 (30.3)	5,006 (22.3)	5,377 (23.9)
1/2	2 (51)	2-1/2 (64)	4,856 (21.6)	5,543 (24.7)	6,142 (27.3)	6,679 (29.7)	9,020 (40.1)	10,072 (44.8)
	2-1/2 (64)	3 (76)	5,839 (26.0)	6,994 (31.1)	8,045 (35.8)	9,020 (40.1)	9,020 (40.1)	10,072 (44.8)
	3-1/4 (83)	3-3/4 (95)	6,714 (29.9)	8,272 (36.8)	9,724 (43.3)	11,006 (49.0)	9,020 (40.1)	10,072 (44.8)
5/8	2-3/4 (70)	3-1/4 (83)	5,694 (25.3)	7,083 (31.5)	8,391 (37.3)	9,636 (42.9)	13,963 (62.1)	14,315 (63.7)
	3-1/4 (83)	3-3/4 (95)	8,527 (37.9)	9,614 (42.8)	10,551 (46.9)	11,385 (50.6)	13,963 (62.1)	14,315 (63.7)
	4 (102)	4-1/2 (114)	10,434 (46.4)	11,954 (53.2)	13,284 (59.1)	14,480 (64.4)	13,963 (62.1)	14,315 (63.7)
3/4	3-1/4 (83)	4 (102)	11,800 (52.5)	12,793 (56.9)	13,620 (60.6)	14,335 (63.8)	17,741 (78.9)	
	3-3/4 (95)	4-1/2 (114)	15,933 (70.9)	17,213 (76.6)	18,276 (81.3)	19,194 (85.4)	17,741 (78.9)	
	4-3/4 (121)	5-1/2 (140)	21,075 (93.7)	22,952 (102.1)	24,522 (109.1)	25,884 (115.1)	17,741 (78.9)	

[1] Testing performed in accordance with ACI 355.2 and ASTM E488.

Table 13 - Allowable Hilti stainless steel KB-TZ2 strength in uncracked concrete for hammer drill and core drill installations[1,2,3,4]

Nominal anchor diameter in.	Effective embedment in. (mm)	Nominal embedment in. (mm)	Tension				Shear	
			f'_c = 3000 psi (20.7 MPa) lb (kN)	f'_c = 4000 psi (27.6 MPa) lb (kN)	f'_c = 5000 psi (34.5 MPa) lb (kN)	f'_c = 6000 psi (41.4 MPa) lb (kN)	f'_c = 3000 psi (20.7 MPa) lb (kN)	f'_c ≥ 4000 psi (27.6 MPa) lb (kN)
1/4	1-1/2 (38)	1-3/4 (44)	524 (2.3)	586 (2.6)	639 (2.8)	685 (3.0)	551 (2.5)	
3/8	1-1/2 (38)	1-7/8 (48)	740 (3.3)	899 (4.0)	1,046 (4.7)	1,184 (5.3)	1,252 (5.6)	1,344 (6.0)
	2 (51)	2-1/2 (64)	1,231 (5.5)	1,419 (6.3)	1,584 (7.0)	1,734 (7.7)	1,252 (5.6)	1,344 (6.0)
	2-1/2 (64)	3 (76)	1,317 (5.9)	1,466 (6.5)	1,592 (7.1)	1,703 (7.6)	1,252 (5.6)	1,344 (6.0)
1/2	2 (51)	2-1/2 (64)	1,214 (5.4)	1,386 (6.2)	1,535 (6.8)	1,670 (7.4)	2,255 (10.0)	2,518 (11.2)
	2-1/2 (64)	3 (76)	1,460 (6.5)	1,748 (7.8)	2,011 (8.9)	2,255 (10.0)	2,255 (10.0)	2,518 (11.2)
	3-1/4 (83)	3-3/4 (95)	1,678 (7.5)	2,068 (9.2)	2,431 (10.8)	2,751 (12.2)	2,255 (10.0)	2,518 (11.2)
5/8	2-3/4 (70)	3-1/4 (83)	1,423 (6.3)	1,771 (7.9)	2,098 (9.3)	2,409 (10.7)	3,491 (15.5)	3,579 (15.9)
	3-1/4 (83)	3-3/4 (95)	2,132 (9.5)	2,403 (10.7)	2,638 (11.7)	2,846 (12.7)	3,491 (15.5)	3,579 (15.9)
	4 (102)	4-1/2 (114)	2,609 (11.6)	2,989 (13.3)	3,321 (14.8)	3,620 (16.1)	3,491 (15.5)	3,579 (15.9)
3/4	3-1/4 (83)	4 (102)	2,950 (13.1)	3,198 (14.2)	3,405 (15.1)	3,584 (15.9)	4,435 (19.7)	
	3-3/4 (95)	4-1/2 (114)	3,983 (17.7)	4,303 (19.1)	4,569 (20.3)	4,798 (21.3)	4,435 (19.7)	
	4-3/4 (121)	5-1/2 (140)	5,269 (23.4)	5,738 (25.5)	6,130 (27.3)	6,471 (28.8)	4,435 (19.7)	

[1] Intermediate load values for other concrete strength and embedments can be calculated by linear interpolation.

[2] Allowable load calculated using a factor of safety of 4.

[3] Apply spacing, edge distance, and concrete thickness factors in tables 16 to 20 as necessary. 1/4551(2.5)Nominal anchor diameterin. Effective embed.in. (mm) Nominal embed. in. (mm)Tension Shear.

[4] With the exception of 3/4" diameter KB-TZ2, the load values in the table can be utilized for either hammer or core drilled installations. Refer to Tables 14 and 15 for 3/4" diameter strength loads.

Table 14 - Ultimate Hilti stainless steel KB-TZ2 tensile strength in uncracked concrete for core drill installations[1]

Nominal anchor diameter in.	Effective embedment in. (mm)	Nominal embedment in. (mm)	Tension				Shear	
			f'_c = 3000 psi (20.7 MPa) lb (kN)	f'_c = 4000 psi (27.6 MPa) lb (kN)	f'_c = 5000 psi (34.5 MPa) lb (kN)	f'_c = 6000 psi (41.4 MPa) lb (kN)	f'_c = 3000 psi (20.7 MPa) lb (kN)	f'_c ≥ 4000 psi (27.6 MPa) lb (kN)
3/4	3-1/4	4	8,735	12,793	13,620	14,335	17,741	
	(83)	(102)	(38.9)	(56.9)	(60.6)	(63.8)	(78.9)	
	3-3/4	4-1/2	12,740	13,666	15,265	16,633	17,741	
	(95)	(114)	(56.7)	(60.8)	(67.9)	(74.0)	(78.9)	
	4-3/4	5-1/2	16,349	17,799	20,352	22,581	17,741	
	(121)	(140)	(72.7)	(79.2)	(90.5)	(100.4)	(78.9)	

[1] Testing performed in accordance with ACI 355.2 and ASTM E488.

Table 15 - Allowable Hilti stainless steel KB-TZ2 tensile strength in uncracked concrete for core drill installations[1,2,3]

Nominal anchor diameter in.	Effective embedment in. (mm)	Nominal embedment in. (mm)	Tension				Shear	
			f'_c = 3000 psi (20.7 MPa) lb (kN)	f'_c = 4000 psi (27.6 MPa) lb (kN)	f'_c = 5000 psi (34.5 MPa) lb (kN)	f'_c = 6000 psi (41.4 MPa) lb (kN)	f'_c = 3000 psi (20.7 MPa) lb (kN)	f'_c ≥ 4000 psi (27.6 MPa) lb (kN)
3/4	3-1/4	4	2,184	3,198	3,405	3,584	4,435	
	(83)	(102)	(9.7)	(14.2)	(15.1)	(15.9)	(19.7)	
	3-3/4	4-1/2	3,185	3,416	3,816	4,158	4,435	
	(95)	(114)	(14.2)	(15.2)	(17.0)	(18.5)	(19.7)	
	4-3/4	5-1/2	4,087	4,450	5,088	5,645	4,435	
	(121)	(140)	(18.2)	(19.8)	(22.6)	(25.1)	(19.7)	

[1] Intermediate load values for other concrete strength and embedments can be calculated by linear interpolation

[2] Allowable load calculated using a factor of safety of 4.

[3] Apply spacing, edge distance, and concrete thickness factors in tables 16 to 20 as necessary.

Table 16 - Load adjustment factors for Stainless Steel 1/4-in. diameter KB-TZ2 in uncracked concrete[1]

1/4-in. KB-TZ2 uncracked concrete			Spacing factor in tension f_{AN}	Edge distance factor in tension f_{RN}	Spacing factor in shear[2] f_{AV}	Edge distance in shear		Concrete thickness factor in shear[3] f_{HV}
						⊥ Toward edge f_{RV}	∥ To edge f_{RV}	
Effective embedment h_{ef}		**in. (mm)**	**1-1/2 (38)**	**1-1/2 (38)**	**1-1/2 (38)**	**1-1/2 (38)**	**1-1/2 (38)**	**1-1/2 (38)**
Nominal embedment h_{nom}		**in. (mm)**	**1-3/4 (44)**	**1-3/4 (44)**	**1-3/4 (44)**	**1-3/4 (44)**	**1-3/4 (44)**	**1-3/4 (44)**
Spacing (s) / Edge Distance (c_a) / Concrete Thickness (h) in. (mm)	1-1/2	(38)	0.67	0.42	0.56	0.23	0.42	n/a
	2	(51)	0.72	0.51	0.58	0.35	0.51	n/a
	2-1/2	(64)	0.78	0.63	0.60	0.49	0.63	n/a
	3	(76)	0.83	0.75	0.63	0.65	0.75	n/a
	3-1/4	(83)	0.86	0.81	0.64	0.73	0.81	0.74
	3-1/2	(89)	0.89	0.88	0.65	0.82	0.88	0.76
	4	(102)	0.94	1.00	0.67	1.00	1.00	0.82
	5	(127)	1.00		0.71			0.91
	6	(152)			0.75			1.00
	7	(178)			0.79			
	8	(203)			0.83			
	9	(229)			0.88			
	> 12	(305)			1.00			

[1] Linear interpolation not permitted

[2] Spacing factor reduction in shear, f_{AV}, is applicable when edge distance $c < 3h_{ef}$. If $c \geq 3h_{ef}$ then $f_{AV} = f_{AN}$.

[3] Concrete thickness reduction factor in shear, f_{HV}, is applicable when edge distance $c < 3h_{ef}$. If $c \geq 3h_{ef}$ then $f_{HV} = 1.0$.

Table 17 - Load adjustment factors for stainless steel 3/8-in. diameter KB-TZ2 in uncracked concrete[1]

3/8-in. KB-TZ2 uncracked concrete			Spacing factor in tension f_{AN}			Edge distance factor in tension f_{RN}			Spacing factor in shear[2] f_{AV}			Edge distance in shear						Concrete thickness factor in shear[3] f_{HV}		
												⊥ Toward edge			∥ To edge					
Effective embedment h_{ef}		**in. (mm)**	**1-1/2 (38)**	**2 (51)**	**2-1/2 (64)**	**1-1/2 (38)**	**2 (51)**	**2-1/2 (64)**	**1-1/2 (38)**	**2 (51)**	**2-1/2 (64)**	**1-1/2 (38)**	**2 (51)**	**2-1/2 (64)**	**1-1/2 (38)**	**2 (51)**	**2-1/2 (64)**	**1-1/2 (38)**	**2 (51)**	**2-1/2 (64)**
Nominal embedment h_{nom}		**in. (mm)**	**1-7/8 (48)**	**2-1/2 (64)**	**3 (76)**	**1-7/8 (48)**	**2-1/2 (64)**	**3 (76)**	**1-7/8 (48)**	**2-1/2 (64)**	**3 (76)**	**1-7/8 (48)**	**2-1/2 (64)**	**3 (76)**	**1-7/8 (48)**	**2-1/2 (64)**	**3 (76)**	**1-7/8 (48)**	**2-1/2 (64)**	**3 (76)**
Spacing (s) / Edge Distance (c_a) / Concrete Thickness (h) in. (mm)	2-1/4	(57)	n/a	0.69	0.65	n/a	n/a	n/a	n/a	0.57	0.55	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	2-1/2	(64)	n/a	0.71	0.67	n/a	0.48	0.68	n/a	0.58	0.55	n/a	0.31	0.18	n/a	0.48	0.37	n/a	n/a	n/a
	3	(76)	n/a	0.75	0.70	n/a	0.55	0.77	n/a	0.59	0.56	n/a	0.40	0.24	n/a	0.55	0.48	n/a	n/a	n/a
	3-1/4	(83)	n/a	0.77	0.72	n/a	0.59	0.81	n/a	0.60	0.57	n/a	0.45	0.27	n/a	0.59	0.54	0.69	n/a	n/a
	3-1/2	(89)	n/a	0.79	0.73	n/a	0.64	0.86	n/a	0.61	0.58	n/a	0.51	0.30	n/a	0.64	0.61	0.72	n/a	n/a
	4	(102)	n/a	0.83	0.77	n/a	0.73	0.97	n/a	0.62	0.59	n/a	0.62	0.37	n/a	0.73	0.74	0.77	0.70	n/a
	5	(127)	1.00	0.92	0.83	1.00	0.91	1.00	0.69	0.65	0.61	1.00	0.87	0.52	1.00	0.91	1.00	0.86	0.78	0.66
	6	(152)	1.00	1.00	0.90	1.00	1.00		0.72	0.68	0.63	1.00	1.00	0.68	1.00	1.00		0.94	0.85	0.72
	8	(203)	1.00		1.00	1.00			0.80	0.74	0.67	1.00		1.00	1.00			1.00	0.98	0.83
	10	(254)							0.87	0.80	0.71								1.00	0.93
	12	(305)							0.94	0.86	0.76									1.00
	18	(457)							1.00	1.00	0.89									
	> 24	(610)									1.00									

[1] Linear interpolation not permitted

[2] Spacing factor reduction in shear, f_{AV}, is applicable when edge distance $c < 3h_{ef}$. If $c \geq 3h_{ef}$ then $f_{AV} = f_{AN}$.

[3] Concrete thickness reduction factor in shear, f_{HV}, is applicable when edge distance $c < 3h_{ef}$. If $c \geq 3h_{ef}$ 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). Refer to the North American Product Technical Guide: Volume 2: Anchor Fastening Technical Guide, Edition 21 (PTG 21) for more information.

Table 18 - Load adjustment factors for stainless steel 1/2-in. diameter KB-TZ2 in uncracked concrete[1]

1/2-in. KB-TZ2 uncracked concrete			Spacing factor in tension f_{AN}			Edge distance factor in tension f_{RN}			Spacing factor in shear[2] f_{AV}			Edge distance in shear						Concrete thickness factor in shear[3] f_{HV}		
												⊥ Toward edge			∥ To edge					
Effective embedment h_{ef}		in. (mm)	2 (51)	2-1/2 (64)	3-1/4 (83)	2 (51)	2-1/2 (64)	3-1/4 (83)	2 (51)	2-1/2 (64)	3-1/4 (83)	2 (51)	2-1/2 (64)	3-1/4 (83)	2 (51)	2-1/2 (64)	3-1/4 (83)	2 (51)	2-1/2 (64)	3-1/4 (83)
Nominal embedment h_{nom}		in. (mm)	2-1/2 (64)	3 (76)	3-3/4 (95)	2-1/2 (64)	3 (76)	3-3/4 (95)	2-1/2 (64)	3 (76)	3-3/4 (95)	2-1/2 (64)	3 (76)	3-3/4 (95)	2-1/2 (64)	3 (76)	3-3/4 (95)	2-1/2 (64)	3 (76)	3-3/4 (95)
Spacing (s) / Edge Distance (c_a) / Concrete Thickness (h) in. (mm)	2	(51)	n/a	n/a	0.60	n/a	n/a	n/a	n/a	n/a	0.54	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	2-1/4	(57)	n/a	n/a	0.62	n/a	n/a	0.40	n/a	n/a	0.54	n/a	n/a	0.12	n/a	n/a	0.24	n/a	n/a	n/a
	2-1/2	(64)	n/a	n/a	0.63	n/a	0.45	0.42	n/a	n/a	0.55	n/a	0.20	0.14	n/a	0.40	0.28	n/a	n/a	n/a
	2-3/4	(70)	n/a	0.68	0.64	0.51	0.48	0.44	n/a	0.56	0.55	0.35	0.23	0.16	0.51	0.46	0.33	n/a	n/a	n/a
	3	(76)	0.75	0.70	0.65	0.55	0.51	0.46	0.59	0.57	0.55	0.40	0.26	0.19	0.55	0.51	0.37	n/a	n/a	n/a
	4	(102)	0.83	0.77	0.71	0.73	0.64	0.56	0.62	0.59	0.57	0.62	0.40	0.29	0.73	0.64	0.56	0.70	n/a	n/a
	4-1/8	(105)	0.84	0.78	0.71	0.75	0.66	0.57	0.63	0.59	0.57	0.65	0.42	0.30	0.75	0.66	0.57	0.71	n/a	n/a
	4-1/2	(114)	0.88	0.80	0.73	0.82	0.72	0.61	0.64	0.60	0.58	0.74	0.48	0.34	0.82	0.72	0.61	0.74	n/a	n/a
	4-3/4	(121)	0.90	0.82	0.74	0.86	0.76	0.64	0.64	0.61	0.59	0.80	0.52	0.37	0.86	0.76	0.64	0.76	n/a	n/a
	5	(127)	0.92	0.83	0.76	0.91	0.80	0.67	0.65	0.61	0.59	0.87	0.56	0.40	0.91	0.80	0.67	0.78	0.67	n/a
	5-1/4	(133)	0.94	0.85	0.77	0.95	0.84	0.70	0.66	0.62	0.60	0.93	0.61	0.43	0.95	0.84	0.70	0.80	0.69	n/a
	5-1/2	(140)	0.96	0.87	0.78	1.00	0.88	0.73	0.67	0.63	0.60	1.00	0.65	0.46	1.00	0.88	0.73	0.82	0.71	0.63
	6	(152)	1.00	0.90	0.81		0.96	0.80	0.68	0.64	0.61		0.74	0.53		0.96	0.80	0.85	0.74	0.66
	8	(203)		1.00	0.91		1.00	1.00	0.74	0.68	0.64		1.00	0.81		1.00	1.00	0.98	0.85	0.76
	12	(305)			1.00				0.86	0.77	0.72			1.00				1.00	1.00	0.93
	18	(457)							1.00	0.91	0.83									1.00
	24	(610)								1.00	0.93									
	> 30	(762)									1.00									

[1] Linear interpolation not permitted
[2] Spacing factor reduction in shear, f_{AV}, is applicable when edge distance $c < 3h_{ef}$. If $c \geq 3h_{ef}$ then $f_{AV} = f_{AN}$.
[3] Concrete thickness reduction factor in shear, f_{HV}, is applicable when edge distance $c < 3h_{ef}$. If $c \geq 3h_{ef}$ 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). Refer to the North American Product Technical Guide: Volume 2: Anchor Fastening Technical Guide, Edition 21 (PTG 21) for more information.

Table 19 - Load adjustment factors for stainless steel 5/8-in. diameter KB-TZ2 in uncracked concrete[1]

5/8-in. KB-TZ2 uncracked concrete			Spacing factor in tension f_{AN}			Edge distance factor in tension f_{RN}			Spacing factor in shear[2] f_{AV}			Edge distance in shear						Concrete thickness factor in shear[3] f_{HV}		
												⊥ Toward edge			∥ To edge					
Effective embedment h_{ef}		in. (mm)	2-3/4 (70)	3-1/4 (83)	4 (102)	2-3/4 (70)	3-1/4 (83)	4 (102)	2-3/4 (70)	3-1/4 (83)	4 (102)	2-3/4 (70)	3-1/4 (83)	4 (102)	2-3/4 (70)	3-1/4 (83)	4 (102)	2-3/4 (70)	3-1/4 (83)	4 (102)
Nominal embedment h_{nom}		in. (mm)	3-1/4 (83)	3-3/4 (95)	4-1/2 (114)	3-1/4 (83)	3-3/4 (95)	4-1/2 (114)	3-1/4 (83)	3-3/4 (95)	4-1/2 (114)	3-1/4 (83)	3-3/4 (95)	4-1/2 (114)	3-1/4 (83)	3-3/4 (95)	4-1/2 (114)	3-1/4 (83)	3-3/4 (95)	4-1/2 (114)
Spacing (s) / Edge Distance (c_a) / Concrete Thickness (h) in. (mm)	2-1/4	(57)	n/a	n/a	0.59	n/a	n/a	n/a	n/a	n/a	0.54	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	2-3/4	(70)	n/a	n/a	0.61	n/a	n/a	0.42	n/a	n/a	0.54	n/a	n/a	0.13	n/a	n/a	0.27	n/a	n/a	n/a
	3	(76)	n/a	0.65	0.63	n/a	n/a	0.44	n/a	0.56	0.55	n/a	n/a	0.15	n/a	n/a	0.30	n/a	n/a	n/a
	3-1/4	(83)	n/a	0.67	0.64	n/a	n/a	0.46	n/a	0.56	0.55	n/a	n/a	0.17	n/a	n/a	0.34	n/a	n/a	n/a
	4	(102)	n/a	0.71	0.67	n/a	0.65	0.51	n/a	0.58	0.56	n/a	0.31	0.23	n/a	0.61	0.47	n/a	n/a	n/a
	4-1/4	(108)	n/a	0.72	0.68	0.43	0.67	0.53	n/a	0.58	0.57	0.28	0.34	0.26	0.43	0.67	0.51	n/a	n/a	n/a
	5	(127)	n/a	0.76	0.71	0.50	0.77	0.60	n/a	0.59	0.58	0.35	0.43	0.33	0.50	0.77	0.60	0.58	n/a	n/a
	5-1/2	(140)	n/a	0.78	0.73	0.55	0.85	0.64	n/a	0.60	0.59	0.41	0.49	0.38	0.55	0.85	0.64	0.61	0.65	n/a
	6	(152)	0.86	0.81	0.75	0.60	0.92	0.69	0.60	0.61	0.59	0.46	0.56	0.43	0.60	0.92	0.69	0.63	0.67	0.62
	7	(178)	0.92	0.86	0.79	0.70	1.00	0.80	0.62	0.63	0.61	0.59	0.71	0.54	0.70	1.00	0.80	0.68	0.73	0.67
	8	(203)	0.98	0.91	0.83	0.80		0.91	0.63	0.65	0.63	0.72	0.87	0.66	0.80		0.91	0.73	0.78	0.71
	10	(254)	1.00	1.00	0.92	1.00		1.00	0.67	0.69	0.66	1.00	1.00	0.92	1.00		1.00	0.82	0.87	0.80
	12	(305)			1.00				0.70	0.73	0.69			1.00				0.89	0.95	0.87
	24	(610)							0.90	0.95	0.88							1.00	1.00	1.00
	> 36	(914)							1.00	1.00	1.00									

[1] Linear interpolation not permitted
[2] Spacing factor reduction in shear, f_{AV}, is applicable when edge distance $c < 3h_{ef}$. If $c \geq 3h_{ef}$ then $f_{AV} = f_{AN}$.
[3] Concrete thickness reduction factor in shear, f_{HV}, is applicable when edge distance $c < 3h_{ef}$. If $c \geq 3h_{ef}$ 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). Refer to the North American Product Technical Guide: Volume 2: Anchor Fastening Technical Guide, Edition 21 (PTG 21) for more information.

Table 20 - Load adjustment factors for stainless steel 3/4-in. diameter KB-TZ2 in uncracked concrete[1]

3/4-in. KB-TZ2 uncracked concrete			Spacing factor in tension f_{AN}			Edge distance factor in tension f_{RN}			Spacing factor in shear[2] f_{AV}			Edge distance in shear						Concrete thickness factor in shear[3] f_{HV}		
												⊥ Toward edge			∥ To edge					
Effective embedment 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 embedment h_{nom}		in. (mm)	4 (102)	4-1/2 (114)	5-1/2 (140)	4 (102)	4-1/2 (114)	5-1/2 (140)	4 (102)	4-1/2 (114)	5-1/2 (140)	4 (102)	4-1/2 (114)	5-1/2 (140)	4 (102)	4-1/2 (114)	5-1/2 (140)	4 (102)	4-1/2 (114)	5-1/2 (140)
Spacing (s) / Edge Distance (c_a) / Concrete Thickness (h) in. (mm)	3-3/4	(95)	n/a	n/a	n/a	n/a	n/a	0.47	n/a	n/a	n/a	n/a	n/a	0.18	n/a	n/a	0.36	n/a	n/a	n/a
	4	(102)	n/a	0.68	0.64	n/a	0.44	0.48	n/a	0.56	0.56	n/a	0.24	0.20	n/a	0.44	0.40	n/a	n/a	n/a
	4-1/2	(114)	n/a	0.70	0.66	n/a	0.48	0.52	n/a	0.57	0.56	n/a	0.29	0.24	n/a	0.48	0.47	n/a	n/a	n/a
	5	(127)	0.76	0.72	0.68	0.42	0.51	0.55	0.57	0.58	0.57	0.27	0.33	0.28	0.42	0.51	0.55	n/a	n/a	n/a
	5-1/4	(133)	0.77	0.73	0.68	0.44	0.53	0.57	0.57	0.58	0.57	0.29	0.36	0.30	0.44	0.53	0.57	n/a	n/a	n/a
	5-1/2	(140)	0.78	0.74	0.69	0.46	0.55	0.59	0.58	0.59	0.58	0.31	0.39	0.32	0.46	0.55	0.59	0.55	n/a	n/a
	5-3/4	(146)	0.79	0.76	0.70	0.48	0.58	0.61	0.58	0.59	0.58	0.33	0.41	0.34	0.48	0.58	0.61	0.57	n/a	n/a
	6	(152)	0.81	0.77	0.71	0.50	0.60	0.63	0.58	0.60	0.58	0.35	0.44	0.36	0.50	0.60	0.63	0.58	0.62	n/a
	7	(178)	0.86	0.81	0.75	0.58	0.70	0.70	0.60	0.61	0.60	0.45	0.55	0.46	0.58	0.70	0.70	0.62	0.67	n/a
	7-1/2	(191)	0.88	0.83	0.76	0.63	0.75	0.75	0.60	0.62	0.61	0.49	0.61	0.51	0.63	0.75	0.75	0.65	0.69	n/a
	8	(203)	0.91	0.86	0.78	0.67	0.80	0.80	0.61	0.63	0.61	0.54	0.68	0.56	0.67	0.80	0.80	0.67	0.72	0.67
	9	(229)	0.96	0.90	0.82	0.75	0.90	0.90	0.63	0.64	0.63	0.65	0.81	0.67	0.75	0.90	0.90	0.71	0.76	0.71
	10	(254)	1.00	0.94	0.85	0.83	1.00	1.00	0.64	0.66	0.64	0.76	0.94	0.78	0.83	1.00	1.00	0.75	0.80	0.75
	11	(279)	1.00	0.99	0.89	0.92			0.65	0.68	0.66	0.88	1.00	0.90	0.92			0.78	0.84	0.79
	12	(305)		1.00	0.92	1.00			0.67	0.69	0.67	1.00		1.00	1.00			0.82	0.88	0.82
	16	(406)			1.00				0.72	0.76	0.73							0.94	1.00	0.95
	18	(457)							0.75	0.79	0.75							1.00		1.00
	24	(610)							0.83	0.89	0.84									
	> 36	(914)							1.00	1.00	1.00									

[1] Linear interpolation not permitted

[2] Spacing factor reduction in shear, f_{AV}, is applicable when edge distance $c < 3h_{ef}$. If $c \geq 3h_{ef}$ then $f_{AV} = f_{AN}$.

[3] Concrete thickness reduction factor in shear, f_{HV}, is applicable when edge distance $c < 3h_{ef}$. If $c \geq 3h_{ef}$ 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). Refer to the North American Product Technical Guide: Volume 2: Anchor Fastening Technical Guide, Edition 21 (PTG 21) for more information.

The data contained herein was current as of the date of publication. Updates and changes may be made based on later testing. If verification is needed that the data is still current, please contact the Hilti Technical Support Specialists at 1-877-749-6337. All published load values herein represent the results of testing by Hilti or test organizations. Because of variations in materials, on-site testing may be necessary to determine performance at any specific site.

Hilti, Inc.
1-800-879-8000 I en español 1-800-879-5000
www.hilti.com

Hilti (Canada) Corporation
1-800-363-4458
www.hilti.ca

WHD • 03/21