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, and corrosion, will be included in the North American Product Technical Guide: Volume 2: Anchor Fastening Technical Guide, Edition 21 (PTG 21).

Table 1 - Setting information

Setting information	Symbol	Units	Nominal anchor diameter (in)															
			1/4	3/8			1/2				5/8			3/4			1	
Nominal bit diameter	d_o	in.	1/4	3/8			1/2				5/8			3/4			1	
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	4	5-3/4
		(mm)	(38)	(38)	(51)	(64)	(38)	(51)	(64)	(83)	(70)	(83)	(102)	(83)	(95)	(121)	(102)	(146)
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	4-5/8	6-3/8
		(mm)	(44)	(48)	(64)	(76)	(51)	(64)	(76)	(95)	(83)	(95)	(114)	(102)	(114)	(140)	(117)	(162)
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	5	6-3/4
		(mm)	(51)	(51)	(70)	(83)	(57)	(70)	(83)	(108)	(95)	(108)	(121)	(108)	(121)	(146)	(127)	(171)
Installation torque carbon steel[1]	T_{inst}	ft-lb	4	30			50				40			110			185	
		(Nm)	(5)	(41)			(68)				(54)			(149)			(251)	
Installation torque stainless steel[1]	T_{inst}	ft-lb	6	30			40				60			125			185	
		(Nm)	(8)	(41)			(54)				(81)			(169)			(251)	
Fixture hole diameter	d_h	in.	5/16	7/16			9/16				11/16			13/16			1-1/8	
		(mm)	(7.9)	(11.1)			(14.3)				(17.5)			(20.6)			(28.6)	

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

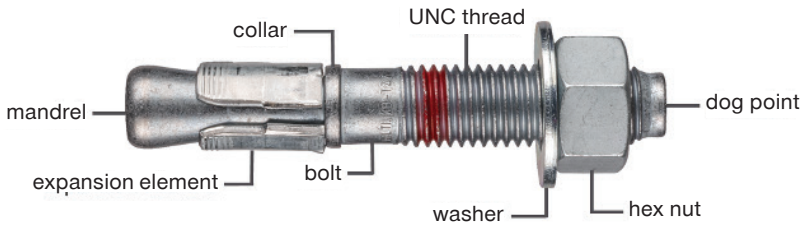

Figure 1 — Hilti carbon steel KWIK BOLT TZ (KB-TZ2)

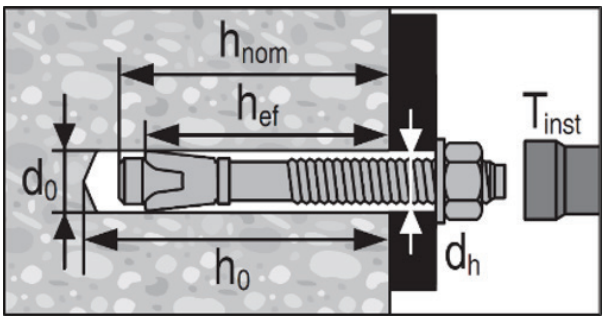

Figure 2 — Hilti KB-TZ2 installed

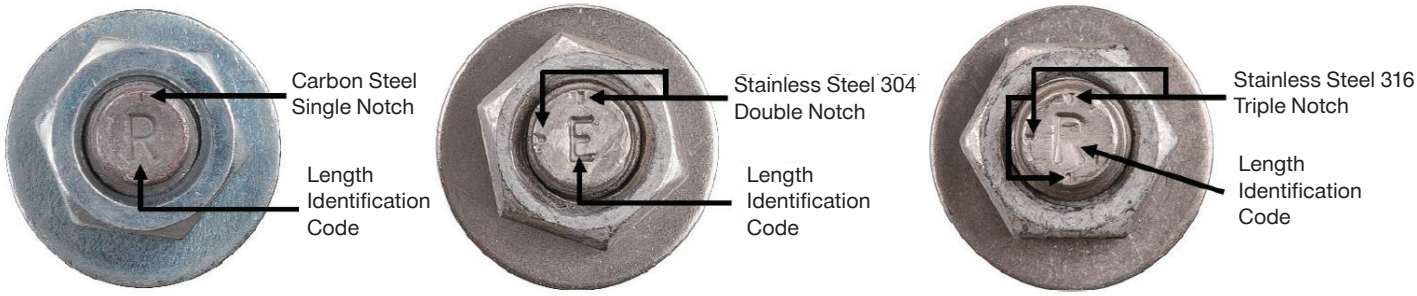

Figure 3 — Bolt head with length identification code and KB-TZ2 head notch embossment

Table 2 - 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			1	
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	4	5-3/4
		(mm)	(38)	(38)	(51)	(64)	(38)	(51)	(64)	(83)	(70)	(83)	(102)	(83)	(95)	(121)	(102)	(146)
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	8	10
		(mm)	(83)	(83)	(102)	(127)	(89)	(102)	(127)	(140)	(127)	(140)	(152)	(140)	(152)	(203)	(203)	(254)
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	8	3
		(mm)	(38)	(127)	(64)	(64)	(203)	(70)	(70)	(57)	(114)	(89)	(70)	(127)	(102)	(89)	(203)	(76)
	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	8	6-3/4
		(mm)	(38)	(203)	(152)	(127)	(305)	(140)	(248)	(133)	(165)	(140)	(184)	(254)	(146)	(140)	(203)	(171)
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	8	4-3/4
		(mm)	(38)	(127)	(57)	(51)	(305)	(89)	(76)	(51)	(114)	(70)	(57)	(114)	(95)	(95)	(203)	(121)
	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	7-1/4	4-3/4	8	3-3/4
		(mm)	(38)	(203)	(89)	(102)	(203)	(254)	(203)	(121)	(140)	(178)	(108)	(152)	(184)	(121)	(203)	(95)
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	3-3/4	3
		(mm)	(38)	(127)	(64)	(64)		(70)	(64)	(57)	(102)	(83)	(57)	(127)	(102)	(95)	(95)	(76)
	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	10	6-3/4
		(mm)	(38)	(203)	(127)	(127)		(140)	(114)	(133)	(178)	(140)	(178)	(279)	(191)	(146)	(254)	(171)
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	5	4-3/4
		(mm)	(38)	(127)	(57)	(57)		(70)	(64)	(51)	(140)	(70)	(76)	(127)	(102)	(102)	(127)	(121)
	for c ≥	In.	1-1/2	8	4	3-1/2		4-1/8	4-1/2	4-1/2	5-1/2	4	4-1/4	8	6	5-1/4	4-1/4	3-3/4
		(mm)	(38)	(203)	(102)	(89)		(105)	(114)	(114)	(140)	(102)	(108)	(203)	(152)	(133)	(108)	(95)

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

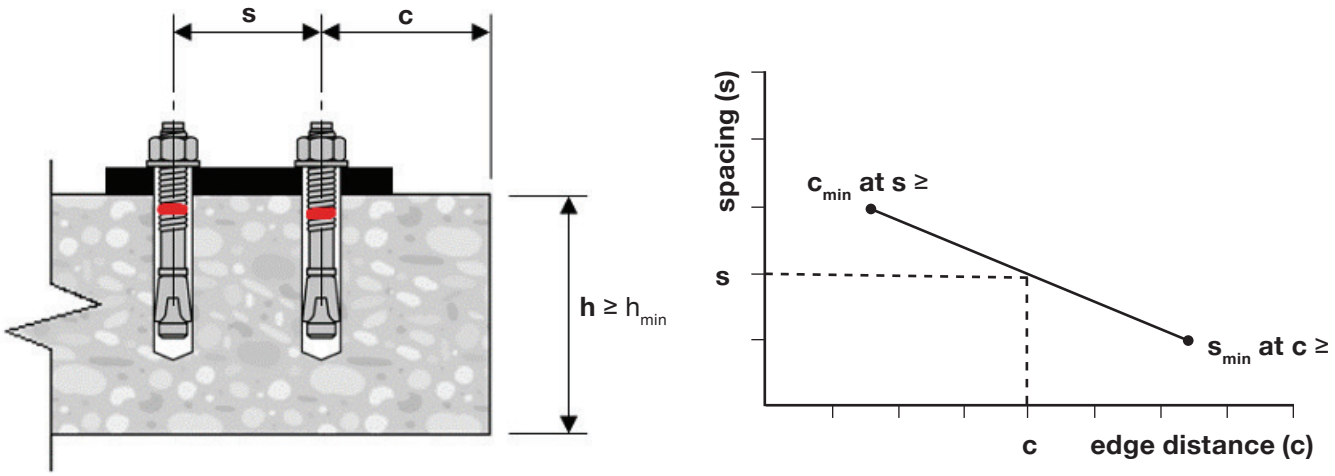

Figure 4 — Interpolation of minimum edge distance and anchor spacing

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	1-3/4	2,421	2,565	2,683	2,783	1,585	1,652
	(38)	(44)	(10.8)	(11.4)	(11.9)	(12.4)	(7.1)	(7.3)
3/8	1-1/2	1-7/8	3,600	3,837	4,032	4,198	3,744	
	(38)	(48)	(16.0)	(17.1)	(17.9)	(18.7)	(16.7)	
	2	2-1/2	4,830	5,173	5,455	5,698	3,744	
	(51)	(64)	(21.5)	(23.0)	(24.3)	(25.3)	(16.7)	
	2-1/2	3	5,557	6,153	6,658	7,102	3,744	
	(64)	(76)	(24.7)	(27.4)	(29.6)	(31.6)	(16.7)	
1/2	1-1/2	2	3,600	4,370	5,079	5,743	6,707	7,577
	(38)	(51)	(16.0)	(19.4)	(22.6)	(25.5)	(29.8)	(33.7)
	2	2-1/2	5,611	6,328	6,948	7,498	6,707	7,577
	(51)	(64)	(25.0)	(28.2)	(30.9)	(33.4)	(29.8)	(33.7)
	2-1/2	3	7,117	7,735	8,251	8,698	6,707	7,577
	(64)	(76)	(31.7)	(34.4)	(36.7)	(38.7)	(29.8)	(33.7)
	3-1/4	3-3/4	9,177	10,148	10,972	11,695	6,707	7,577
	(83)	(95)	(40.8)	(45.1)	(48.8)	(52.0)	(29.8)	(33.7)
5/8	2-3/4	3-1/4	7,246	8,505	9,631	10,661	11,650	
	(70)	(83)	(32.2)	(37.8)	(42.8)	(47.4)	(51.8)	
	3-1/4	3-3/4	10,319	11,854	13,199	14,411	11,650	
	(83)	(95)	(45.9)	(52.7)	(58.7)	(64.1)	(51.8)	
	4	4-1/2	10,795	12,625	14,257	15,745	11,650	
	(102)	(114)	(48.0)	(56.2)	(63.4)	(70.0)	(51.8)	
3/4	3-1/4	4	12,014	13,279	14,352	15,292	15,120	
	(83)	(102)	(53.4)	(59.1)	(63.8)	(68.0)	(67.3)	
	3-3/4	4-1/2	15,639	17,088	18,304	19,362	15,120	
	(95)	(114)	(69.6)	(76.0)	(81.4)	(86.1)	(67.3)	
	4-3/4	5-1/2	17,914	20,067	21,914	23,548	15,120	
	(121)	(140)	(79.7)	(89.3)	(97.5)	(104.7)	(67.3)	
1	4	4-5/8	15,332	17,637	19,662	21,487	25,244	
	(102)	(117)	(68.2)	(78.5)	(87.5)	(95.6)	(112.3)	
	5-3/4	6-3/8	27,245	30,408	33,112	35,499	25,244	
	(146)	(162)	(121.2)	(135.3)	(147.3)	(157.9)	(112.3)	

[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	4 (102)	4-5/8 (117)	3,833 (17.1)	4,409 (19.6)	4,915 (21.9)	5,372 (23.9)	6,311 (28.1)	
	5-3/4 (146)	6-3/8 (162)	6,811 (30.3)	7,602 (33.8)	8,278 (36.8)	8,875 (39.5)	6,311 (28.1)	

[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 12 as necessary.

[4] With the exception of 1/4", 3/4", and 1" diameters, 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. 1/4" and 1" diameters may not be installed using core drilling.

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 ≥ 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 ≥ 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 table 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 is 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 f_{RV}			∥ To edge f_{RV}					
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 is 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 f_{RV}				∥ To edge f_{RV}							
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 is 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 f_{RV}			∥ To edge f_{RV}					
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 is 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 f_{RV}			∥ To edge f_{RV}					
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
	7-1/4	(184)	0.87	0.82	0.75	0.60	0.73	0.81	0.60	0.62	0.60	0.47	0.58	0.48	0.60	0.73	0.81	0.63	0.68	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 is 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 - Load adjustment factors for carbon steel 1-in. diameter KB-TZ2 in uncracked concrete[1]

1-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)	4 (102)	5-3/4 (146)	4 (102)	5-3/4 (146)	4 (102)	5-3/4 (146)	4 (102)	5-3/4 (146)	4 (102)	5-3/4 (146)	4 (102)	5-3/4 (146)
Nominal embedment h_{nom}		in. (mm)	4-5/8 (117)	6-3/8 (162)	4-5/8 (117)	6-3/8 (162)	4-5/8 (117)	6-3/8 (162)	4-5/8 (117)	6-3/8 (162)	4-5/8 (117)	6-3/8 (162)	4-5/8 (117)	6-3/8 (162)
Spacing (s) / Edge Distance (c_a) / Concrete Thickness (h) in. (mm)	3	(76)	n/a	n/a	n/a	0.29	n/a	n/a	n/a	0.08	n/a	0.16	n/a	n/a
	3-3/4	(95)	n/a	n/a	n/a	0.32	n/a	n/a	n/a	0.11	n/a	0.23	n/a	n/a
	4	(102)	n/a	n/a	n/a	0.33	n/a	n/a	n/a	0.13	n/a	0.25	n/a	n/a
	4-1/4	(108)	n/a	n/a	n/a	0.34	n/a	n/a	n/a	0.14	n/a	0.27	n/a	n/a
	4-3/4	(121)	n/a	0.64	n/a	0.36	n/a	0.55	n/a	0.16	n/a	0.32	n/a	n/a
	5	(127)	n/a	0.64	n/a	0.37	n/a	0.55	n/a	0.17	n/a	0.35	n/a	n/a
	6	(152)	n/a	0.67	n/a	0.42	n/a	0.56	n/a	0.23	n/a	0.42	n/a	n/a
	6-3/4	(171)	n/a	0.70	n/a	0.45	n/a	0.57	n/a	0.27	n/a	0.45	n/a	n/a
	8	(203)	0.83	0.73	0.73	0.51	0.62	0.58	0.62	0.35	0.73	0.51	0.70	n/a
	10	(254)	0.92	0.79	0.91	0.63	0.65	0.60	0.87	0.49	0.91	0.63	0.78	0.65
	12	(305)	1.00	0.85	1.00	0.75	0.68	0.63	1.00	0.65	1.00	0.75	0.85	0.71
	18	(457)		1.00		1.00	0.77	0.69		1.00		1.00	1.00	0.87
	24	(610)					0.86	0.75						1.00
	36	(914)					1.00	0.88						
	> 48	(1219)						1.00						

[1] Linear interpolation is 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 13 - 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	4 (102)	4-5/8 (117)	16,505 (73.4)	19,299 (85.8)	21,788 (96.9)	24,058 (107.0)	28,386 (126.3)	29,934 (133.2)
	5-3/4 (146)	6-3/8 (162)	26,059 (115.9)	31,770 (141.3)	37,047 (164.8)	42,003 (186.8)	28,386 (126.3)	29,934 (133.2)

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

Table 14 - 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	4 (102)	4-5/8 (117)	4,126 (18.4)	4,825 (21.5)	5,447 (24.2)	6,015 (26.8)	7,096 (31.6)	7,483 (33.3)
	5-3/4 (146)	6-3/8 (162)	6,515 (29.0)	7,942 (35.3)	9,262 (41.2)	10,501 (46.7)	7,096 (31.6)	7,483 (33.3)

[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 17 to 22 as necessary.

[4] With the exception of 1/4", 3/4" and 1" diameters, 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. 1/4" and 1" diameters may not be installed using core drilling.

Table 15 - 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 16 - 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 21 as necessary.

Table 17 - 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 is 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 18 - 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 is 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 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 is 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 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 is 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 21 - 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 is 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 22 - Load adjustment factors for Stainless Steel 1-in. diameter KB-TZ2 in uncracked concrete[1]

1-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)	4 (102)	5-3/4 (146)	4 (102)	5-3/4 (146)	4 (102)	5-3/4 (146)	4 (102)	5-3/4 (146)	4 (102)	5-3/4 (146)	4 (102)	5-3/4 (146)
Nominal embedment h_{nom}	in. (mm)	4-5/8 (117)	6-3/8 (162)	4-5/8 (117)	6-3/8 (162)	4-5/8 (117)	6-3/8 (162)	4-5/8 (117)	6-3/8 (162)	4-5/8 (117)	6-3/8 (162)	4-5/8 (117)	6-3/8 (162)
Spacing (s) / Edge Distance (c_a) / Concrete Thickness (h) in. (mm)	3	(76)	n/a	n/a	n/a	0.30	n/a	n/a	n/a	0.09	n/a	0.17	n/a	n/a
	3-3/4	(95)	n/a	n/a	0.39	0.33	n/a	n/a	0.20	0.12	0.39	0.24	n/a	n/a
	4	(102)	n/a	n/a	0.41	0.34	n/a	n/a	0.22	0.13	0.41	0.26	n/a	n/a
	4-1/4	(108)	n/a	n/a	0.43	0.35	n/a	n/a	0.24	0.14	0.43	0.29	n/a	n/a
	4-3/4	(121)	n/a	0.64	0.46	0.37	n/a	0.55	0.28	0.17	0.46	0.34	n/a	n/a
	5	(127)	0.71	0.64	0.48	0.38	0.58	0.55	0.31	0.18	0.48	0.37	n/a	n/a
	6	(152)	0.75	0.67	0.55	0.43	0.59	0.56	0.40	0.24	0.55	0.43	n/a	n/a
	6-3/4	(171)	0.78	0.70	0.61	0.46	0.60	0.57	0.48	0.29	0.61	0.46	n/a	n/a
	8	(203)	0.83	0.73	0.73	0.52	0.62	0.59	0.62	0.37	0.73	0.52	0.70	n/a
	10	(254)	0.92	0.79	0.91	0.65	0.65	0.61	0.87	0.52	0.91	0.65	0.78	0.66
	12	(305)	1.00	0.85	1.00	0.77	0.68	0.63	1.00	0.68	1.00	0.77	0.85	0.72
	18	(457)		1.00		1.00	0.77	0.69		1.00		1.00	1.00	0.88
	24	(610)					0.86	0.76						1.00
	36	(914)					1.00	0.89						
	> 48	(1219)						1.00						

[1] Linear interpolation is 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.

Interaction - ASD

Where anchors are loaded simultaneously in tension and shear, interaction must be considered. The usual form of the interaction equation for anchors is as follows:

$$V_{rec} = \left[\frac{N_d}{N_{rec}}\right]^{\alpha} + \left[\frac{V_d}{V_{rec}}\right]^{\alpha} \leq 1.0$$

where:

N_d = design tension load (ASD);

V_d = design shear load (ASD); and

α = exponent, $1 \leq \alpha \leq 2$

The value used for α corresponds to the type of interaction equation being considered. A value of $\alpha = 1.0$ corresponds to a straight line interaction equation, while a value of $\alpha = 5/3$ corresponds to a parabolic interaction equation.

Anchor Component Dimensions

Table 23 - Hilti KB-TZ2 washer with nut thicknesses, dogpoint length, and threads per inch[1]

KB-TZ 2 diameter	Washer thickness (in)	Nut thickness (in)	Dogpoint length (in)	Threads per inch
1/4"	0.065	0.219	0.075	20
3/8"	0.065	0.328	0.075	16
1/2"	0.095	0.438	0.122	13
5/8"	0.095	0.547	0.138	11
3/4"	0.134	0.641	0.157	10
1"	0.134	0.859	0.177	8

[1] Refer to Figure 1 for KB-TZ2 washer, nut, thread and dogpoint locations on anchor.

KB-TZ2 Portfolio

Table 24 - Hilti KB-TZ2 carbon steel product portfolio

Description	Length (in)	Length ident. letter	Thread length (in)	Nominal embed. 1 (in)	Min. fixture thickness 1 (in)	Max. fixture thickness 1 (in)	Nominal embed. 2 (in)	Min. fixture thickness 2 (in)	Max. fixture thickness 2 (in)	Nominal embed. 3 (in)	Min. fixture thickness 3 (in)	Max. fixture thickness 3 (in)	Nominal embed. 4 (in)	Min. fixture thickness 4 (in)	Max. fixture thickness 4 (in)	Qty.
KB-TZ2 1/4x2-1/8	2-1/8	B	7/8	1-3/4	0	1/8	-	-	-	-	-	-	-	-	-	100
KB-TZ2 1/4x2-1/2	2-1/2	C	1 1/4	1-3/4	0	1/2	-	-	-	-	-	-	-	-	-	100
KB-TZ2 1/4x3-1/4	3-1/4	D	2	1-3/4	0	1-1/4	-	-	-	-	-	-	-	-	-	100
KB-TZ2 1/4x4-1/2	4-1/2	G	3	1-3/4	1/8	2-1/2	-	-	-	-	-	-	-	-	-	100
KB-TZ2 3/8x2-1/2	2-1/2	C	1	1-7/8	0	1/4	-	-	-	-	-	-	-	-	-	50
KB-TZ2 3/8x3	3	D	1 1/2	1-7/8	0	3/4	2-1/2	0	1/4	-	-	-	-	-	-	50
KB-TZ2 3/8x3-1/2	3-1/2	Ω	2	1-7/8	0	1-1/4	2-1/2	0	3/4	3	0	1/4	-	-	-	50
KB-TZ2 3/8x3-3/4	3-3/4	E	2 1/4	1-7/8	0	1-1/2	2-1/2	0	1	3	0	1/2	-	-	-	50
KB-TZ2 3/8x5	5	H	3 1/2	1-7/8	0	2-3/4	2-1/2	0	2-1/4	3	0	1-3/4	-	-	-	50
KB-TZ2 3/8x7	7	L	4 7/8	1-7/8	1/2	4-3/4	2-1/2	0	4-1/4	3	0	3-3/4	-	-	-	50
KB-TZ2 1/2x3	3	D	1 1/8	2	1/4	1/2	2-1/2	0	0	-	-	-	-	-	-	20
KB-TZ2 1/2x3-3/4	3-3/4	E	1 5/8	2	1/2	1-1/4	2-1/2	0	3/4	3	0	1/4	-	-	-	20
KB-TZ2 1/2x4-1/2	4-1/2	G	2 3/8	2	1/2	2	2-1/2	0	1-1/2	3	0	1	3-3/4	0	1/4	20
KB-TZ2 1/2x5-1/2	5-1/2	I	3 3/8	2	1/2	3	2-1/2	0	2-1/2	3	0	2	3-3/4	0	1-1/4	20
KB-TZ2 1/2x7	7	L	4 3/4	2	5/8	4-1/2	2-1/2	1/8	4	3	0	3-1/2	3-3/4	0	2-3/4	20
KB-TZ2 1/2x8-1/2	8-1/2	O	4 7/8	2	2	6	2-1/2	1-1/2	5-1/2	3	1	5	3-3/4	1/4	4-1/4	20
KB-TZ2 1/2x10	10	R	4 7/8	2	3-1/2	7-1/2	2-1/2	3	7	3	2-1/2	6-1/2	3-3/4	1-3/4	5-3/4	20
KB-TZ2 5/8x4-1/4	4-1/4	F	2 1/4	3-1/4	0	3/8	-	-	-	-	-	-	-	-	-	15
KB-TZ2 5/8x4-3/4	4-3/4	G	2 3/4	3-1/4	0	7/8	3-3/4	0	3/8	-	-	-	-	-	-	15
KB-TZ2 5/8x5-1/2	5-1/2	I	3 1/2	3-1/4	0	1-5/8	3-3/4	0	1-1/8	4-1/2	0	3/8	-	-	-	15
KB-TZ2 5/8x6	6	J	4	3-1/4	0	2-1/8	3-3/4	0	1-5/8	4-1/2	0	7/8	-	-	-	15
KB-TZ2 5/8x7	7	L	4 7/8	3-1/4	0	3-1/8	3-3/4	0	2-5/8	4-1/2	0	1-7/8	-	-	-	15
KB-TZ2 5/8x8-1/2	8-1/2	O	6 1/2	3-1/4	0	4-5/8	3-3/4	0	4-1/8	4-1/2	0	3-3/8	-	-	-	15
KB-TZ2 5/8x10	10	R	7 1/8	3-1/4	1/8	6-1/8	3-3/4	0	5-5/8	4-1/2	0	4-7/8	-	-	-	15
KB-TZ2 3/4x4-3/4	4-3/4	G	2 1/2	4	0	1/8	-	-	-	-	-	-	-	-	-	10
KB-TZ2 3/4x5-1/2	5-1/2	I	3 1/4	4	0	7/8	4-1/2	0	3/8	-	-	-	-	-	-	10
KB-TZ2 3/4x6-1/4	6-1/4	J	3 1/4	4	0	1-5/8	4-1/2	0	1-1/8	5-1/2	0	1/8	-	-	-	10
KB-TZ2 3/4x7	7	L	4	4	0	2-3/8	4-1/2	0	1-7/8	5-1/2	0	7/8	-	-	-	10
KB-TZ2 3/4x8	8	N	5	4	0	3-3/8	4-1/2	0	2-7/8	5-1/2	0	1-7/8	-	-	-	10
KB-TZ2 3/4x9	9	P	6	4	0	4-3/8	4-1/2	0	3-7/8	5-1/2	0	2-7/8	-	-	-	10
KB-TZ2 3/4x10	10	R	7	4	0	5-3/8	4-1/2	0	4-7/8	5-1/2	0	3-7/8	-	-	-	10
KB-TZ2 1x6-1/2	6-1/2	K	2 1/2	4 5/8	0	1-1/8	6-3/8	-	-	-	-	-	-	-	-	10
KB-TZ2 1x8	8	N	3 7/8	4 5/8	0	2-5/8	6-3/8	0	7/8	-	-	-	-	-	-	10
KB-TZ2 1x9	9	P	3 7/8	4 5/8	7/8	3-5/8	6-3/8	0	1-7/8	-	-	-	-	-	-	10
KB-TZ2 1x10-1/2	10-1/2	R	6	4 5/8	3/8	5-1/8	6-3/8	0	3-3/8	-	-	-	-	-	-	10
KB-TZ2 1x12	12	T	6	4 5/8	1-7/8	6-5/8	6-3/8	1/8	4-7/8	-	-	-	-	-	-	10

Table 25 - Hilti KB-TZ2 SS304 product portfolio

Description	Length (in)	Length ident. letter	Thread length (in)	Nominal embed. 1 (in)	Min. fixture thickness 1 (in)	Max. fixture thickness 1 (in)	Nominal embed. 2 (in)	Min. fixture thickness 2 (in)	Max. fixture thickness 2 (in)	Nominal embed. 3 (in)	Min. fixture thickness 3 (in)	Max. fixture thickness 3 (in)	Qty.
KB-TZ2 1/4x2-1/8 SS304	2-1/8	B	7/8	1-3/4	0	1/8	-	-	-	-	-	-	100
KB-TZ2 1/4x2-1/2 SS304	2-1/2	C	1 1/4	1-3/4	0	1/2	-	-	-	-	-	-	100
KB-TZ2 1/4x3-1/4 SS304	3-1/4	D	2	1-3/4	0	1-1/4	-	-	-	-	-	-	100
KB-TZ2 1/4x4-1/2 SS304	4-1/2	G	3	1-3/4	1/8	2-1/2	-	-	-	-	-	-	100
KB-TZ2 3/8x2-1/2 SS304	2-1/2	C	1	1-7/8	0	1/4	-	-	-	-	-	-	50
KB-TZ2 3/8x3 SS304	3	D	1 1/2	1-7/8	0	3/4	2-1/2	0	1/4	-	-	-	50
KB-TZ2 3/8x3-1/2 SS304	3-1/2	Ω	2	1-7/8	0	1-1/4	2-1/2	0	3/4	3	0	1/4	50
KB-TZ2 3/8x3-3/4 SS304	3-3/4	E	2 1/4	1-7/8	0	1-1/2	2-1/2	0	1	3	0	1/2	50
KB-TZ2 3/8x5 SS304	5	H	3 1/2	1-7/8	0	2-3/4	2-1/2	0	2-1/4	3	0	1-3/4	50
KB-TZ2 3/8x7 SS304	7	L	4 7/8	1-7/8	1/2	4-3/4	2-1/2	0	4-1/4	3	0	3-3/4	50
KB-TZ2 1/2x3-3/4 SS304	3-3/4	E	1 5/8	2-1/2	0	3/4	3	0	1/4	-	-	-	20
KB-TZ2 1/2x4-1/2 SS304	4-1/2	G	2 3/8	2-1/2	0	1-1/2	3	0	1	3-3/4	0	1/4	20
KB-TZ2 1/2x5-1/2 SS304	5-1/2	I	3 3/8	2-1/2	0	2-1/2	3	0	2	3-3/4	0	1-1/4	20
KB-TZ2 1/2x7 SS304	7	L	4 3/4	2-1/2	1/8	4	3	0	3-1/2	3-3/4	0	2-3/4	20
KB-TZ2 5/8x4-1/4 SS304	4-1/4	F	2 1/4	3-1/4	0	3/8	-	-	-	-	-	-	15
KB-TZ2 5/8x4-3/4 SS304	4-3/4	G	2 3/4	3-1/4	0	7/8	3-3/4	0	3/8	-	-	-	15
KB-TZ2 5/8x6 SS304	6	J	4	3-1/4	0	2-1/8	3-3/4	0	1-5/8	4-1/2	0	7/8	15
KB-TZ2 5/8x7 SS304	7	L	4 7/8	3-1/4	0	3-1/8	3-3/4	0	2-5/8	4-1/2	0	1-7/8	15
KB-TZ2 5/8x8-1/2 SS304	8-1/2	O	6 1/2	3-1/4	0	4-5/8	3-3/4	0	4-1/8	4-1/2	0	3-3/8	15
KB-TZ2 5/8x10 SS304	10	R	7 1/8	3-1/4	1/8	6-1/8	3-3/4	0	5-5/8	4-1/2	0	4-7/8	15
KB-TZ2 3/4x4-3/4 SS304	4-3/4	G	1 3/4	4	0	1/8	-	-	-	-	-	-	10
KB-TZ2 3/4x5-1/2 SS304	5-1/2	I	2 1/2	4	0	7/8	4-1/2	0	3/8	-	-	-	10
KB-TZ2 3/4x6-1/4 SS304	6-1/4	J	3 1/4	4	0	1-5/8	4-1/2	0	1-1/8	5-1/2	0	1/8	10
KB-TZ2 3/4x7 SS304	7	L	4	4	0	2-3/8	4-1/2	0	1-7/8	5-1/2	0	7/8	10
KB-TZ2 3/4x8 SS304	8	N	5	4	0	3-3/8	4-1/2	0	2-7/8	5-1/2	0	1-7/8	10
KB-TZ2 3/4x9 SS304	9	P	6	4	0	4-3/8	4-1/2	0	3-7/8	5-1/2	0	2-7/8	10
KB-TZ2 3/4x10 SS304	10	R	7	4	0	5-3/8	4-1/2	0	4-7/8	5-1/2	0	3-7/8	10
KB-TZ2 3/4x12 SS304	12	T	7	4	1-5/8	7-3/8	4-1/2	1-1/8	6-7/8	5-1/2	1/8	5-7/8	10
KB-TZ2 1x6-1/2 SS304	6-1/2	K	2 1/2	4-5/8	0	7/8	6-3/8	-	-	-	-	-	10
KB-TZ2 1x8 SS304	8	N	3 7/8	4-5/8	0	2-3/8	6-3/8	0	7/8	-	-	-	10
KB-TZ2 1x9 SS304	9	P	3 7/8	4-5/8	1	3-3/8	6-3/8	0	1-7/8	-	-	-	10
KB-TZ2 1x10-1/2 SS304	10-1/2	R	6	4 5/8	1/2	4-7/8	6-3/8	0	3-3/8	-	-	-	10
KB-TZ2 1x12 SS304	12	T	6	4 5/8	2	6-3/8	6-3/8	1/4	4-7/8	-	-	-	10

Table 26 - Hilti KB-TZ2 SS316 product portfolio

Description	Length (in)	Length ident. letter	Thread length (in)	Nominal embed. 1 (in)	Min. fixture thickness 1 (in)	Max. fixture thickness 1 (in)	Nominal embed. 2 (in)	Min. fixture thickness 2 (in)	Max. fixture thickness 2 (in)	Nominal embed. 3 (in)	Min. fixture thickness 3 (in)	Max. fixture thickness 3 (in)	Qty.
KB-TZ2 1/4x2-1/2 SS316	2-1/2	C	1-1/4	1-3/4	0	1/2	-	-	-	-	-	-	100
KB-TZ2 1/4x3-1/4 SS316	3-1/4	D	2	1-3/4	0	1-1/4	-	-	-	-	-	-	100
KB-TZ2 1/4x4-1/2 SS316	4-1/2	G	3	1-3/4	1/8	2-1/2	-	-	-	-	-	-	100
KB-TZ2 3/8x2-1/2 SS316	2-1/2	C	1	1-7/8	0	1/4	-	-	-	-	-	-	50
KB-TZ2 3/8x3 SS316	3	D	1-1/2	1-7/8	0	3/4	2-1/2	0	1/4	-	-	-	50
KB-TZ2 3/8x3-1/2 SS316	3-1/2	Ω	2	1-7/8	0	1-1/4	2-1/2	0	3/4	3	0	1/4	50
KB-TZ2 3/8x3-3/4 SS316	3-3/4	E	2-1/4	1-7/8	0	1-1/2	2-1/2	0	1	3	0	1/2	50
KB-TZ2 3/8x5 SS316	5	H	3-1/2	1-7/8	0	2-3/4	2-1/2	0	2-1/4	3	0	1-3/4	50
KB-TZ2 3/8x7 SS316	7	L	4-7/8	1-7/8	1/2	4-3/4	2-1/2	0	4-1/4	3	0	3-3/4	50
KB-TZ2 1/2x3-3/4 SS316	3-3/4	E	1-5/8	2-1/2	0	3/4	3	0	1/4	-	-	-	20
KB-TZ2 1/2x4-1/2 SS316	4-1/2	G	2-3/8	2-1/2	0	1-1/2	3	0	1	3-3/4	0	1/4	20
KB-TZ2 1/2x5-1/2 SS316	5-1/2	I	3-3/8	2-1/2	0	2-1/2	3	0	2	3-3/4	0	1-1/4	20
KB-TZ2 1/2x7 SS316	7	L	4-3/4	2-1/2	1/8	4	3	0	3-1/2	3-3/4	0	2-3/4	20
KB-TZ2 1/2x8-1/2 SS316	8-1/2	O	4-7/8	2-1/2	1-1/2	5-1/2	3	1	5	3-3/4	1/4	4-1/4	20
KB-TZ2 1/2x10 SS316	10	R	4-7/8	2-1/2	3	7	3	2-1/2	6-1/2	3-3/4	1-3/4	5-3/4	20
KB-TZ2 5/8x4-1/4 SS316	4-1/4	F	2-1/4	3-1/4	0	3/8	-	-	-	-	-	-	15
KB-TZ2 5/8x4-3/4 SS316	4-3/4	G	2-3/4	3-1/4	0	7/8	3-3/4	0	3/8	-	-	-	15
KB-TZ2 5/8x6 SS316	6	J	4	3-1/4	0	2-1/8	3-3/4	0	1-5/8	4-1/2	0	7/8	15
KB-TZ2 5/8x7 SS316	7	L	4-7/8	3-1/4	0	3-1/8	3-3/4	0	2-5/8	4-1/2	0	1-7/8	15
KB-TZ2 5/8x8-1/2 SS316	8-1/2	O	6-1/2	3-1/4	0	4-5/8	3-3/4	0	4-1/8	4-1/2	0	3-3/8	15
KB-TZ2 5/8x10 SS316	10	R	7-1/8	3-1/4	1/8	6-1/8	3-3/4	0	5-5/8	4-1/2	0	4-7/8	15
KB-TZ2 3/4x4-3/4 SS316	4-3/4	G	1-3/4	4	0	1/8	-	-	-	-	-	-	10
KB-TZ2 3/4x5-1/2 SS316	5-1/2	I	2-1/2	4	0	7/8	4-1/2	0	3/8	-	-	-	10
KB-TZ2 3/4x6-1/4 SS316	6-1/4	J	3-1/4	4	0	1-5/8	4-1/2	0	1-1/8	5-1/2	0	1/8	10
KB-TZ2 3/4x7 SS316	7	L	4	4	0	2-3/8	4-1/2	0	1-7/8	5-1/2	0	7/8	10
KB-TZ2 3/4x8 SS316	8	N	5	4	0	3-3/8	4-1/2	0	2-7/8	5-1/2	0	1-7/8	10
KB-TZ2 3/4x9 SS316	9	P	6	4	0	4-3/8	4-1/2	0	3-7/8	5-1/2	0	2-7/8	10
KB-TZ2 3/4x10 SS316	10	R	7	4	0	5-3/8	4-1/2	0	4-7/8	5-1/2	0	3-7/8	10
KB-TZ2 3/4x12 SS316	12	T	7	4	1-5/8	7-3/8	4-1/2	1-1/8	6-7/8	5-1/2	1/8	5-7/8	10

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.

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