3.3.4.1 KWIK Bolt TZ Product Description

The KWIK Bolt TZ (KB-TZ) is a torque controlled expansion anchor which is especially suited to seismic and cracked concrete applications. This anchor line is available in carbon steel, type 304 and type 316 stainless steel versions. The anchor diameters range from 3/8- and 3/4-inch in a variety of lengths. Applicable base materials include normal-weight concrete, structural lightweight concrete, and lightweight concrete over metal deck.

Guide Specifications

Torque controlled expansion anchors shall be KWIK Bolt TZ (KB-TZ) supplied by Hilti meeting the description in Federal Specification A-A 1923A, type 4. The anchor bears a length identification mark embossed into the impact section (dog point) of the anchor surrounded by four embossed notches identifying the anchor as a Hilti KWIK Bolt TZ in the installed condition. Anchors are manufactured to meet one of the following conditions:

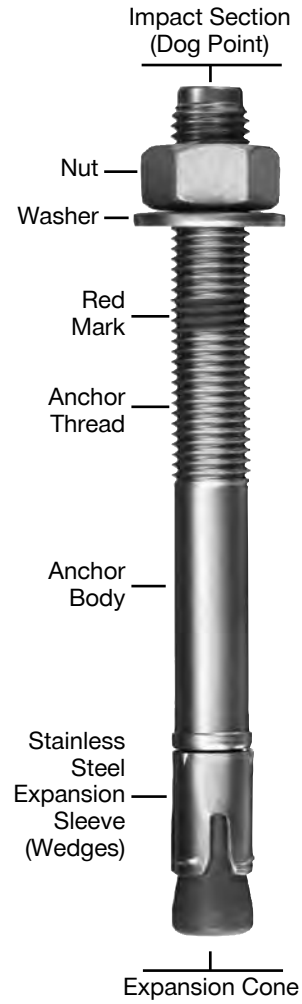
- The carbon steel anchor body, nut, and washer have an electro-plated zinc coating conforming to ASTM B633 to a minimum thickness of 5 µm. The stainless steel expansion sleeve conforms to type 316.
- Stainless steel anchor body, nut and washer conform to type 304. Stainless steel expansion sleeve conforms to type 316.
- Stainless steel anchor body, nut, washer, and expansion sleeve conform to type 316 stainless steel.

Product Features

- Product and length identification marks facilitate quality control after installation.
- Through fixture installation and variable thread lengths improve productivity and accommodate various base plate thicknesses.
- Type 316 Stainless Steel wedges provide superior performance in cracked concrete.
- Ridges on expansion wedges provide increased reliability.
- Mechanical expansion allows immediate load application.
- Raised impact section (dog point) prevents thread damage during installation.
- Bolt meets ductility requirements of ACI 318 Section D1.

Installation

Drill hole in base material to the appropriate depth using a Hilti carbide tipped drill bit. Drive the anchor into the hole using a hammer. A minimum of four threads must be below the fastening surface prior to applying installation torque. Tighten the nut to the installation torque.



Listings/Approvals

ICC-ES (International Code Council)
ESR-1917

FM (Factory Mutual)
Pipe Hanger Components for Automatic Sprinkler Systems (3/8" - 3/4")

UL (Underwriters Laboratories)
Pipe Hanger Equipment for Fire Protection Services (3/8" - 3/4")

Independent Code Evaluation

IBC® / IRC® 2009 (AC 193 / ACI 355.2)

IBC® / IRC® 2006

Supplemental Design Provisions for ACI 318 Appendix D

Design strengths are determined in accordance with ACI 318 Appendix D and ICC Evaluation Service ESR-1917 Hilti KWIK Bolt TZ Carbon and Stainless Steel Anchors in Concrete. The relevant design parameters are reiterated in Tables 1, 2, and 3 of this document. Supplemental provisions required for the design of the KB-TZ are enumerated in Section 4.0 of ESR-1917 (DESIGN AND INSTALLATION). Note that these design parameters are supplemental to the design provisions of ACI 318.

3.3.4 KWIK Bolt TZ Expansion Anchor

3.3.4.2 Material Properties

Carbon steel with electroplated zinc

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

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

- Carbon steel anchor components plated in accordance with ASTM B633 to a minimum thickness of 5µm.
- Nuts conform to the requirements of ASTM A 563, Grade A, Hex.
- Washers meet the requirements of ASTM F 844.
- Expansion sleeves (wedges) are manufactured from type 316 stainless steel.

Stainless steel

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

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

- All nuts and washers are made from type 304 or type 316 stainless steel respectively.
- Nuts meet the dimensional requirements of ASTM F 594.
- Washers meet the dimensional requirements of ANSI B18.22.1, Type A, plain.
- Expansion Sleeve (wedges) are made from type 316 stainless steel.

1 Bolt fracture loads are determined by testing in jig as part of product QC. These loads are not intended for design purposes. See Tables 2 and 3.

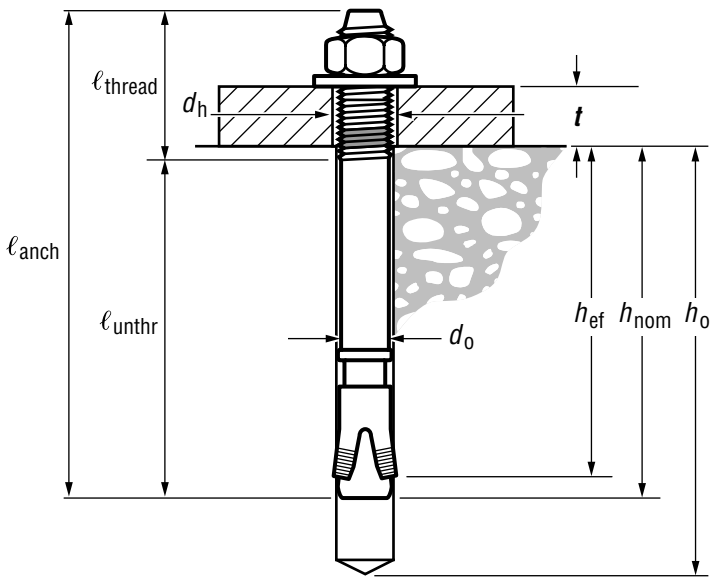
3.3.4.3 Technical Data

Table 1 — KWIK Bolt TZ Specification Table

Setting Information	Symbol	Units	Nominal anchor diameter (in.)													
			3/8			1/2			5/8				3/4			
Anchor O.D.	d_o	in.	0.375			0.5			0.625				0.75			
		(mm)	(9.5)			(12.7)			(15.9)				(19.1)			
Nominal bit diameter	d_{bit}	in.	3/8			1/2			5/8				3/4			
Effective minimum embedment	h_{ef}	in.	2			2		3-1/4	3-1/8		4		3-3/4		4-3/4	
		(mm)	(51)			(51)		(83)	(79)		(102)		(95)		(121)	
Min. hole depth	h_o	in.	2-5/8			2-5/8		4	3-3/4		4-3/4		4-5/8		5-3/4	
		(mm)	(67)			(67)		(102)	(95)		(121)		(117)		(146)	
Min. thickness of fixture[1]	t_{min}	in.	1/4			3/4		1/4	3/8		3/4		1/8		1-5/8	
		(mm)	(6)			(19)		(6)	(9)		(19)		(3)		(41)	
Max. thickness of fixture	t_{max}	in.	2-1/4			4		2-3/4	5-5/8		4-3/4		4-5/8		3-5/8	
		(mm)	(57)			(101)		(70)	(143)		(121)		(117)		(92)	
Installation torque	T_{inst}	ft-lb	25			40			60				110			
		(Nm)	(34)			(54)			(81)				(149)			
Minimum diameter of hole	d_h	in.	7/16			9/16			11/16				13/16			
		(mm)	(11.1)			(14.3)			(17.5)				(20.6)			
Available anchor lengths	ℓ_{anch}	in.	3	3-3/4	5	3-3/4	4-1/2	5-1/2	7	4-3/4	6	8-1/2	10	5-1/2	8	10
		(mm)	(76)	(95)	(127)	(95)	(114)	(140)	(178)	(121)	(152)	(216)	(254)	(140)	(203)	(254)
Threaded length including dog point	ℓ_{thread}	in.	7/8	1-5/8	2-7/8	1-5/8	2-3/8	3-3/8	4-7/8	1-1/2	2-3/4	5-1/4	6-3/4	1-1/2	4	6
		(mm)	(22)	(41)	(73)	(41)	(60)	(86)	(178)	(38)	(70)	(133)	(171)	(38)	(102)	(152)
Unthreaded length	ℓ_{unthr}	in.	2-1/8			2-1/8			3-1/4				4			
		(mm)	(54)			(54)			(83)				(102)			
Installation embedment	h_{nom}	in.	2-1/4			2-3/8		3-5/8	3-5/8		4-1/2		4-3/8		5-3/8	
		(mm)	(57)			(60)		(92)	(92)		(114)		(111)		(137)	

1 The minimum thickness of the fastened part is based on use of the anchor at minimum embedment and is controlled by the length of thread. If a thinner fastening thickness is required, increase the anchor embedment to suit.

Figure 1 — KWIK Bolt TZ Installed



3.3.4 KWIK Bolt TZ Expansion Anchor

Table 2 — Carbon Steel KWIK Bolt TZ Strength Design Information

Setting Information	Symbol	Units	Nominal anchor diameter											
			3/8		1/2				5/8			3/4		
Anchor O.D.	d_o	in. (mm)	0.375 (9.5)		0.5 (12.7)				0.625 (15.9)			0.75 (19.1)		
Effective minimum embedment[1]	h_{ef}	in. (mm)	2 (51)		2 (51)		3-1/4 (83)		3-1/8 (79)	4 (102)		3-3/4 (95)		4-3/4 (121)
Min. member thickness	h_{min}	in. (mm)	4 (102)	5 (127)	4 (102)	6 (152)	6 (152)	8 (203)	5 (127)	6 (152)	8 (203)	6 (152)	8 (203)	8 (203)
Critical edge distance	c_{ac}	in. (mm)	4-3/8 (111)	4 (102)	5-1/2 (140)	4-1/2 (114)	7-1/2 (191)	6 (152)	6-1/2 (165)	8-3/4 (222)	6-3/4 (171)	10 (254)	8 (203)	9 (229)
Min. edge distance	$c_{a,min}$	in. (mm)	2-1/2 (64)		2-3/4 (70)		2-3/8 (60)		3-5/8 (92)	3-1/4 (83)		4-3/4 (121)		4-1/8 (105)
	for s ≥	in. (mm)	5 (127)		5-3/4 (146)		5-3/4 (146)		6-1/8 (156)	5-7/8 (149)		10-1/2 (267)		8-7/8 (225)
Min. anchor spacing	s_{min}	in. (mm)	2-1/2 (64)		2-3/4 (70)		2-3/8 (60)		3-1/2 (89)	3 (76)		5 (127)		4 (102)
	for c ≥	in. (mm)	3-5/8 (92)		4-1/8 (105)		3-1/2 (89)		4-3/4 (121)	4-1/4 (108)		9-1/2 (241)		7-3/4 (197)
Min. hole depth in concrete	h_o	in. (mm)	2-5/8 (67)		2-5/8 (67)		4 (102)		3-7/8 (98)	4-3/4 (121)		4-5/8 (117)		5-3/4 (146)
Min. specified yield strength	f_{ya}	lb/in² (N/mm²)	100,000 (690)		84,800 (585)				84,800 (585)			84,800 (585)		
Min. specified ult. strength	f_{uta}	lb/in² (N/mm²)	125,000 (793)		106,000 (731)				106,000 (731)			106,000 (731)		
Effective tensile stress area	A_{se}	in.² (mm²)	0.052 (33.6)		0.101 (65.0)				0.162 (104.6)			0.237 (152.8)		
Steel strength in tension	N_{sa}	lb (kN)	6,500 (28.9)		10,705 (47.6)				17,170 (76.4)			25,120 (111.8)		
Steel strength in shear	V_{sa}	lb (kN)	3,595 (16.0)		5,495 (24.4)				8,090 (36.0)			13,675 (60.8)		
Steel strength in shear, seismic	V_{eq}	lb (kN)	2,255 (10.0)		5,495 (24.4)				7,600 (33.8)			11,745 (52.2)		
Steel strength in shear, concrete on metal deck[2]	$V_{sa,deck}$	lb (kN)	2,130[10] (9.5)		3,000 (13.3)		4,945 (22)		4,600[10] (20.5)	6,040[10] (26.9)		NP		
Pullout strength uncracked concrete[3]	$N_{p,uncr}$	lb (kN)	2515 (11.2)		NA		5,515 (24.5)		NA	9,145 (40.7)		8,280 (36.8)	10,680 (47.5)	
Pullout strength cracked concrete[3]	$N_{p,cr}$	lb (kN)	2270 (10.1)		NA		4,915 (21.9)		NA			NA		
Pullout strength concrete on metal deck[4]	$N_{p,deck,cr}$	lb (kN)	1,460 (6.5)		1,460 (6.5)		2,620 (11.7)		2,000 (8.9)	4,645 (20.7)		NP		
Anchor category[5]			1											
Effectiveness factor k_{uncr} uncracked concrete			24											
Effectiveness factor k_{cr} cracked concrete[6]			17											
$\psi_{c,N} = k_{uncr}/k_{cr}$[7]			1.41											
Coefficient for pryout strength, k_{cp}			1.0				2.0							
Strength reduction factor Φ for tension, steel failure modes[8]			0.75											
Strength reduction factor Φ for shear, steel failure modes[8]			0.65											
Strength reduction factor Φ for tension, concrete failure modes, Condition B[9]			0.65											
Strength reduction factor Φ for shear, concrete failure modes			0.70											

1 See Fig. 1.

2 NP (not permitted) denotes that the condition is not supported.

3 NA (not applicable) denotes that this value does not control for design.

4 NP (not permitted) denotes that the condition is not supported. Values are for cracked concrete. Values are applicable to both static and seismic load combinations.

5 See ACI 318 D.4.4.

6 See ACI 318 D.5.2.2.

7 See ACI 318 D.5.2.6.

8 The KB-TZ is a ductile steel element as defined by ACI 318 D.1.

9 For use with the load combinations of ACI 318 Chapter 9 Section 9.2. Condition B applies where supplementary reinforcement in conformance with ACI 318 D.4.4 is not provided, or where pullout or pryout strength governs. For cases where the presence of supplementary reinforcement can be verified, the strength reduction factors associated with Condition A may be used.

10 For seismic applications, multiply the value of $V_{sa,deck}$ for the 3/8-inch-diameter by 0.63 and the 5/8-inch-diameter by 0.94.

KWIK Bolt TZ Expansion Anchor 3.3.4

Table 3 — Stainless Steel KWIK Bolt TZ Strength Design Information

Setting Information	Symbol	Units	Nominal anchor diameter											
			3/8		1/2				5/8			3/4		
Anchor O.D.	d_o	in. (mm)	0.375 (9.5)		0.5 (12.7)				0.625 (15.9)			0.75 (19.1)		
Effective minimum embedment[1]	h_{ef}	in. (mm)	2 (51)		2 (51)		3-1/4 (83)		3-1/8 (79)	4 (102)		3-3/4 (95)		4-3/4 (121)
Min. member thickness	h_{min}	in. (mm)	4 (102)	5 (127)	4 (102)	6 (152)	6 (152)	8 (203)	5 (127)	6 (152)	8 (203)	6 (152)	8 (203)	
Critical edge distance	c_{ac}	in. (mm)	4-3/8 (111)	3-7/8 (98)	5-1/2 (140)	4-1/2 (114)	7-1/2 (191)	6 (152)	7 (178)	8-7/8 (225)	6 (152)	10 (254)	7 (178)	9 (229)
Min. edge distance	$c_{a,min}$	in. (mm)	2-1/2 (64)		2-7/8 (73)		2-1/8 (54)		3-1/4 (83)	2-3/8 (60)		4-1/4 (108)		4 (102)
	for s ≥	in. (mm)	5 (127)		5-3/4 (146)		5-1/4 (133)		5-1/2 (140)	5-1/2 (140)		10 (254)		8-1/2 (216)
Min. anchor spacing	s_{min}	in. (mm)	2-1/4 (57)		2-7/8 (73)		2 (51)		2-3/4 (70)	2-3/8 (60)		5 (127)		4 (102)
	for c ≥	in. (mm)	3-1/2 (89)		4-1/2 (114)		3-1/4 (83)		4-1/8 (105)	4-1/4 (108)		9-1/2 (241)		7 (178)
Min. hole depth in concrete	h_o	in. (mm)	2-5/8 (67)		2-5/8 (67)		4 (102)		3-3/4 (95)	4-3/4 (121)		4-5/8 (117)		5-3/4 (146)
Min. specified yield strength	f_{ya}	lb/in2 (N/mm2)	92,000 (634)		92,000 (634)				92,000 (634)			76,125 (525)		
Min. specified ult. strength	f_{uta}	lb/in2 (N/mm2)	115,000 (793)		115,000 (793)				115,000 (793)			101,500 (700)		
Effective tensile stress area	A_{se}	in2 (mm2)	0.052 (33.6)		0.101 (65.0)				0.162 (104.6)			0.237 (152.8)		
Steel strength in tension	N_{sa}	lb (kN)	5,980 (26.6)		11,615 (51.7)				18,630 (82.9)			24,055 (107.0)		
Steel strength in shear	V_{sa}	lb (kN)	4,870 (21.7)		6,880 (30.6)				9,350 (41.6)			12,890 (57.3)		
Steel strength in tension, seismic[2]	N_{eq}	lb (kN)	NA		2,735 (12.2)		NA		NA			NA		
Steel strength in shear, seismic[2]	V_{eq}	lb (kN)	2,825 (12.6)		6,880 (30.6)				11,835 (52.6)			14,615 (65.0)		
Pullout strength uncracked concrete[2]	$N_{p,uncr}$	lb (kN)	2,630 (11.7)		NA		5,760 (25.6)		NA			NA		12,040 (53.6)
Pullout strength cracked concrete[2]	$N_{p,cr}$	lb (kN)	2,340 (10.4)		3,180 (14.1)		NA		NA		5,840 (26.0)	8,110 (36.1)		NA
Anchor category[3]			1		2		1							
Effectiveness factor k_{uncr} uncracked concrete			24											
Effectiveness factor k_{cr} cracked concrete[4]			17		24		17		17		17	24		17
$\psi_{c,N} = k_{uncr}/k_{cr}$[5]			1.41		1.00		1.41		1.41		1.41	1.00		1.41
Coefficient for pryout strength, k_{cp}			1.0				2.0							
Strength reduction factor Φ for tension, steel failure modes[6]			0.75											
Strength reduction factor Φ for shear, steel failure modes[6]			0.65		0.55		0.65							
Strength reduction factor Φ for tension, concrete failure modes, Condition B[7]			0.65											
Strength reduction factor Φ for shear, concrete failure modes			0.70											

1 See Fig. 1.

2 NA (not applicable) denotes that this value does not control for design.

3 See ACI 318 D.4.4.

4 See ACI 318 D.5.2.2.

5 See ACI 318 D.5.2.6.

6 The KB-TZ is a ductile steel element as defined by ACI 318 D.1.

7 For use with the load combinations of ACI 318 Chapter 9 Section 9.2. Condition B applies where supplementary reinforcement in conformance with ACI 318 D.4.4 is not provided, or where pullout or pryout strength governs. For cases where the presence of supplementary reinforcement can be verified, the strength reduction factors associated with Condition A may be used.

3.3.4 KWIK Bolt TZ Expansion Anchor

Figure 2 — Interpolation of Minimum Edge Distance and Anchor Spacing

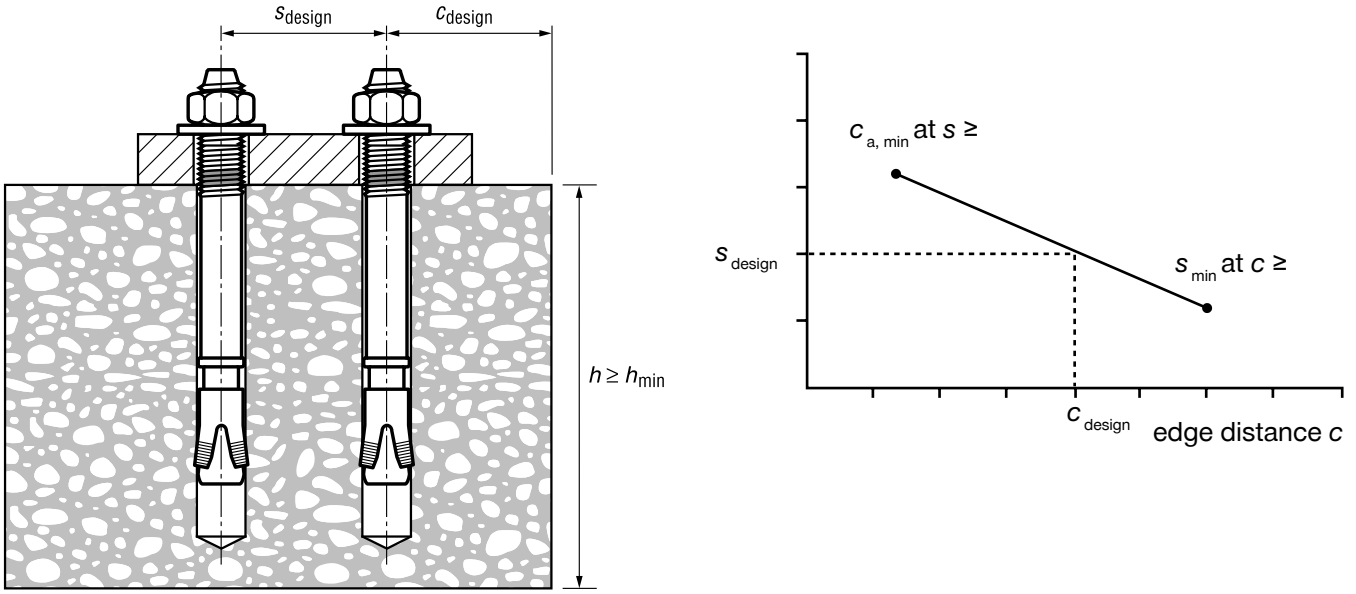
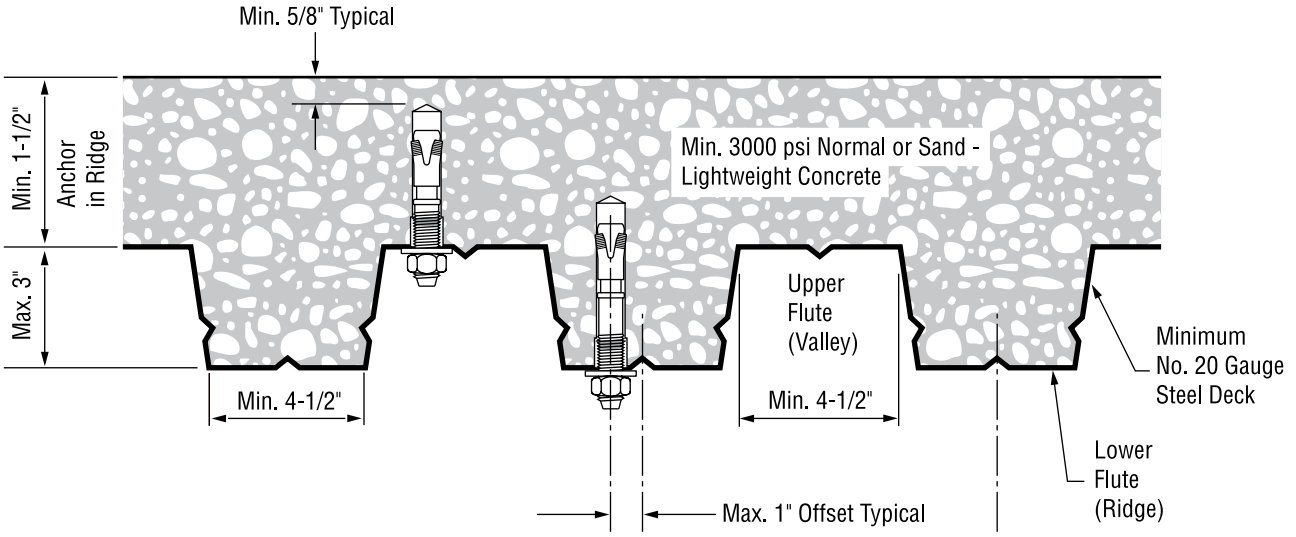


Table 4 — Mean Axial Stiffness Values (1,000 lb/in.) for KWIK Bolt TZ Carbon and Stainless Steel Anchors in Normal-Weight Concrete[1]

Concrete condition	carbon steel KB-TZ, all diameters	stainless steel KB-TZ, all diameters
uncracked concrete	700	120
cracked concrete	500	90

1 Mean values shown. Actual stiffness may vary considerably depending on concrete strength, loading and geometry of application.

Figure 3 — Installation in Concrete over Metal Deck Floor



Allowable Stress Design

Design values for use with allowable stress design (working stress design) shall be established as follows: $R_{allow,ASD} = \frac{R_d}{\alpha}$

where $R_d = \Phi R_k$ represents the limiting design strength in tension (ΦN_n) or shear (ΦV_n) as calculated according to ACI 318 D.4.1.1 and D.4.1.2

Table 5 - KWIK Bolt TZ Carbon and Stainless Steel Allowable Nonseismic Tension (ASD), Normal-Weight Uncracked Concrete (lb)[1,2,3,4,5,6]

Diameter	h_{ef} (in.)	Concrete Compressive Strength							
		f'_c = 2,500 psi		f'_c = 3,000 psi		f'_c = 4,000 psi		f'_c = 6,000 psi	
		Carbon Steel	Stainless Steel	Carbon Steel	Stainless Steel	Carbon Steel	Stainless Steel	Carbon Steel	Stainless Steel
3/8	2	1,168	1,221	1,279	1,338	1,477	1,545	1,809	1,892
1/2	2	1,576	1,576	1,726	1,726	1,993	1,993	2,441	2,441
	3-1/4	2,561	2,674	2,805	2,930	3,239	3,383	3,967	4,143
5/8	3-1/8	3,078	3,078	3,372	3,372	3,893	3,893	4,768	4,768
	4	4,246	4,457	4,651	4,883	5,371	5,638	6,578	6,905
3/4	3-3/4	3,844	4,046	4,211	4,432	4,863	5,118	5,956	6,268
	4-3/4	4,959	5,590	5,432	6,124	6,272	7,071	7,682	8,660

1 Single anchors with no edge or anchor spacing reductions and no supplementary reinforcement (Condition B).

2 Concrete determined to remain uncracked for the life of the anchorage.

3 Strength design load combinations from ACI 318 Section 9.2. ASD load combinations from ASCE 7-05, Section 2.

4 For strength design, the required strength = 1.2D + 1.6L. For ASD, the factored load = 1.0D + 1.0L. Conversion factor α is calculated by dividing the ACI 318 required strength by the ASCE 7 factored load.

5 Assuming a 50% dead and 50% live contributions, $\alpha = (1.2 \cdot 0.5 + 1.6 \cdot 0.5) / (1.0 \cdot 0.5 + 1.0 \cdot 0.5) = 1.4$

6 ASD = $\Phi_{concrete} \cdot N_{p,uncr} / \alpha = 0.65 \cdot N_{p,uncr} / 1.4$

Table 6 - KWIK Bolt TZ Carbon and Stainless Steel Allowable Nonseismic Tension (ASD), Normal-Weight Cracked Concrete (lb)[1,2,3,4,5]

Diameter	h_{ef} (in.)	Concrete Compressive Strength							
		f'_c = 2500 psi		f'_c = 3000 psi		f'_c = 4000 psi		f'_c = 6000 psi	
		Carbon Steel	Stainless Steel	Carbon Steel	Stainless Steel	Carbon Steel	Stainless Steel	Carbon Steel	Stainless Steel
3/8	2	1,054	1,086	1,155	1,190	1,333	1,374	1,633	1,683
1/2	2	1,116	1,476	1,223	1,617	1,412	1,868	1,729	2,287
	3-1/4	2,282	2,312	2,500	2,533	2,886	2,886	3,535	3,582
5/8	3-1/8	2,180	2,180	2,388	2,388	2,758	2,925	3,377	3,377
	4	3,157	2,711	3,458	2,970	3,994	3,430	4,891	4,201
3/4	3-3/4	2,866	3,765	3,139	4,125	3,625	4,763	4,440	5,833
	4-3/4	4,085	4,085	4,475	4,475	5,168	5,168	6,329	6,329

1 Single anchors with no edge or anchor spacing reductions and no supplementary reinforcement (Condition B).

2 Strength design load combinations from ACI 318 Section 9.2. ASD load combinations from ASCE 7-05, Section 2.

3 For strength design, the required strength = 1.2D + 16L. For ASD, the factored load = 1.0D + 1.0L. Conversion factor α is calculated by dividing the ACI 318 required strength by the ASCE 7 factored load.

4 Assuming a 50% dead and 50% live contributions, $\alpha = (1.2 \cdot 0.5 + 1.6 \cdot 0.5) / (1.0 \cdot 0.5 + 1.0 \cdot 0.5) = 1.4$

5 ASD = $\Phi_{concrete} \cdot N_{p,cr} / \alpha = 0.65 \cdot N_{p,cr} / 1.4$

3.3.4 KWIK Bolt TZ Expansion Anchor

Table 7 - KWIK Bolt TZ Carbon and Stainless Steel Allowable Nonseismic Shear (ASD), Steel (lb)[1,2,3,4,5,6]

Diameter (in.)	Allowable Steel Capacity, Shear	
	Carbon Steel	Stainless Steel
3/8	1,925	2,530
1/2	2,945	3,685
5/8	4,335	5,290
3/4	7,325	8,415

1 Single anchors with no edge or anchor spacing reductions and no supplementary reinforcement (Condition B).

2 Strength design load combinations from ACI 318 Section 9.2. ASD load combinations from ASCE 7-05, Section 2.

3 For strength design, the required strength = 1.2D + 1.6L. For ASD, the factored load = 1.0D + 1.0L. Conversion factor α is calculated by dividing the ACI 318 required strength by the ASCE 7 factored load.

4 ASD = $\Phi_{steel} \cdot V_{sa} / \alpha = 0.75 \cdot V_{sa} / 1.4$

Table 8 - KWIK Bolt TZ Carbon and Stainless Steel Allowable Seismic Tension (ASD), Normal-Weight Cracked Concrete (lb)[1,2,3,4,5]

Diameter	h_{ef} (in.)	Concrete Compressive Strength[2]							
		f'_c = 2500 psi		f'_c = 3000 psi		f'_c = 4000 psi		f'_c = 6000 psi	
		Carbon Steel	Stainless Steel	Carbon Steel	Stainless Steel	Carbon Steel	Stainless Steel	Carbon Steel	Stainless Steel
3/8	2	774	882	937	966	1,082	1,115	1,225	1,366
1/2	2	906	1,198	992	1,312	1,146	1,515	1,297	1,856
	3-1/4	1,852	1,876	2,028	2,055	2,342	2,373	2,651	2,907
5/8	3-1/8	1,769	1,769	1,938	1,938	2,238	2,238	2,533	2,741
	4	2,562	2,200	2,806	2,410	3,240	2,783	3,668	3,408
3/4	3-3/4	2,325	3,055	2,547	3,347	2,941	3,865	3,330	4,733
	4-3/4	3,315	3,315	3,632	3,632	4,193	4,193	4,747	5,136

1 Single anchors with no edge or anchor spacing reductions and no supplementary reinforcement (Condition B).

2 Strength design load combinations from ACI 318 Section 9.2. ASD load combinations from ASCE 7-05, Section 2.

3 For strength design, the required strength = 1.2D + 1.0E. For ASD, the factored load = 1.0D + 0.7E. Conversion factor α is calculated by dividing the ACI 318 required strength by the ASCE 7 factored load.

4 Assuming a 50% dead and 50% earthquake contributions, $\alpha = (1.2 \cdot 0.5 + 1.0 \cdot 0.5) / (1.0 \cdot 0.5 + 0.7 \cdot 0.5) = 1.294$

5 ASD = $\Phi_{concrete} \cdot \Phi_{seismic} \cdot N_{p,uncr} / \alpha = 0.65 \cdot 0.75 \cdot N_{p,uncr} / 1.294$

Table 9 - KWIK Bolt TZ Carbon and Stainless Steel Allowable Seismic Shear (ASD), Steel (lb)[1,2,3,4,5]

Diameter (in.)	Allowable Steel Capacity, Shear	
	Carbon Steel	Stainless Steel
3/8	1,565	1,915
1/2	2,390	2,590
5/8	3,515	4,005
3/4	5,945	6,375

1 Single anchors with no edge or anchor spacing reductions and no supplementary reinforcement (Condition B).

2 Strength design load combinations from ACI 318 Section 9.2. ASD load combinations from ASCE 7-05, Section 2.

3 For strength design, the required strength = 1.2D + 1.0E. For ASD, the factored load = 1.0D + 0.7E. Conversion factor α is calculated by dividing the ACI 318 required strength by the ASCE 7 factored load.

4 Assuming a 50% dead and 50% earthquake contributions, $\alpha = (1.2 \cdot 0.5 + 1.0 \cdot 0.5) / (1.0 \cdot 0.5 + 0.7 \cdot 0.5) = 1.294$

5 Seismic ASD = $\Phi_{steel} \cdot \Phi_{seismic} \cdot V_{eq} / \alpha = 0.75 \cdot 0.75 \cdot Veq / 1.294$

Table 10 - KWIK Bolt TZ Allowable Tension and Shear Loads (ASD), Installed into the Underside of Lightweight Concrete over Metal Deck Slab[1,2]

Nominal Anchor Diameter	Embedment Depth h_{ef} (in.)	Tension Nonseismic[3,4,5] (lb)	Tension Seismic[7,8,9] (lb)	Shear Nonseismic[3,4,6] (lb)	Shear Seismic[7,8,10] (lb)
3/8	2	680	550	1,140	930
1/2	2	680	550	1,607	1,310
1/2	3 1/4	1,215	990	2,650	2,155
5/8	3 1/8	929	755	2,465	2,005
5/8	4	2,157	1,755	3,235	2,635

1 Single anchors with no edge or anchor spacing reductions and no supplementary reinforcement (Condition B).

2 Strength design load combinations from ACI 318 Section 9.2. ASD load combinations from ASCE 7-05, Section 2.

3 For strength design, the required strength = 1.2D + 1.6L. For ASD, the factored load = 1.0D + 1.0L. Conversion factor α is calculated by dividing the ACI 318 required strength by the ASCE 7 factored load.

4 Assuming a 50% dead and 50% live contributions, $\alpha = (1.2 \cdot 0.5 + 1.6 \cdot 0.5) / (1.0 \cdot 0.5 + 1.0 \cdot 0.5) = 1.4$

5 $ASD = \Phi_{concrete} \cdot N_{p,deck,cr} / \alpha = 0.65 \cdot N_{p,deck,cr} / 1.4$

6 $ASD = \Phi_{steel} \cdot V_{s,deck} / \alpha = 0.75 \cdot V_{s,deck} / 1.4$

7 For strength design, the required strength = 1.2D + 1.0E. For ASD, the factored load = 1.0D + 0.7E. Conversion factor α is calculated by dividing the ACI 318 required strength by the ASCE 7 factored load.

8 Assuming a 50% dead and 50% earthquake contributions, $\alpha = (1.2 \cdot 0.5 + 1.0 \cdot 0.5) / (1.0 \cdot 0.5 + 0.7 \cdot 0.5) = 1.294$

9 $ASD = \Phi_{concrete} \cdot \Phi_{seismic} \cdot N_{p,deck,cr} / \alpha = 0.65 \cdot 0.75 \cdot N_{p,deck,cr} / 1.294$

10 10. Seismic $ASD = \Phi_{concrete} \cdot \Phi_{seismic} \cdot V_{s,deck} / \alpha = 0.75 \cdot 0.75 \cdot V_{s,deck} / 1.294$

Table 11 — KWIK Bolt TZ Length Identification System

Length ID marking on bolt head		A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W
Length of anchor, ℓ_{anch} (in.)	From	1½	2	2½	3	3½	4	4½	5	5½	6	6½	7	7½	8	8½	9	9½	10	11	12	13	14	15
	Up to but not including	2	2½	3	3½	4	4½	5	5½	6	6½	7	7½	8	8½	9	9½	10	11	12	13	14	15	16

Figure 4 — Bolt Head with Length Identification Mark and KWIK Bolt TZ Head Notch Embossment

3.3.4 KWIK Bolt TZ Expansion Anchor

TABLE 12 - KWIK Bolt TZ Design Information in accordance with CSA A23.3-04 Annex D[1]

Design Parameter	Symbol	Units	Nominal anchor diameter												Ref.
			3/8		1/2			5/8			3/4				A23.3-04
Anchor O.D.	d_o	mm	9.5		12.7			15.9			19.1				
		(in.)	0.375		0.5			0.625			0.75				
Effective min. embedment depth	$h_{ef,\ min}$	mm	51		51		83	79	102		95		121		
		(in.)	2		2		3-1/4	3-1/8	4		3-3/4		4-3/4		
Min. member thickness	h_{min}	mm	102	127	102	152	152 203	127	152	203	152	203	203		
Critical edge distance	c_{ac}	mm	111	102	140	114	191 152	165	222	171	254	203	229		
Minimum edge distance	c_{ac}	mm	64		70		60	92	83		121		105		
	for s >	mm	127		146		146	156	149		267		225		
Minimum anchor spacing	s_{min}	mm	64		70		60	89	76		127		102		
	for c >	mm	92		105		89	121	108		241		197		
Minimum hole depth in concrete	h_o	mm	67		67		102	98	121		117		146		
Min. edge distance	1, 2 or 3		1												D.5.4c
Concrete material resistance factor for concrete	Φ_c		0.65												8.4.2
Steel embedment material resistance factor for reinforcement	Φ_s		0.85												8.4.3
Strength reduction factor for tension, steel failure modes	R		0.80												D.5.4a
Strength reduction factor for shear, steel failure modes	R		0.75												D.5.4a
Strength reduction factor for tension, concrete failure modes	R	Cond. A	1.15												D.5.4c
	R	Cond. B	1.00												D.5.4c
Strength reduction factor for shear, concrete failure modes	R	Cond. A	1.15												D.5.4c
	R	Cond. B	1.00												D.5.4c
Yield strength of anchor steel	f_y	MPa	690		585			585			585				
Ultimate strength of anchor steel	f_{ut}	MPa	862		731			731			731				
Effective cross-sectional area	A_{se}	mm^2	33.6		65.0			104.6			152.8				
Coefficient for factored concrete breakout resistance in tension	k		7												D.6.2.6
Modification factor for resistance in tension to account for uncracked concrete	$\Psi_{c,N}$		1.4												D.6.2.6
Factored Steel Resistance in tension	N_{sr}	kN	19.7		32.3			52.0			76.0				D.6.1.2
Factored Steel Resistance in shear	V_{sr}	kN	10.2		18.2			29.9			45.2				D.7.1.2c
Factored Steel Resistance in shear, seismic	$V_{sr,\ seismic}$	kN	6.4		18.2			29.9			40.4				
Factored Steel Resistance in shear, concrete on metal deck	$V_{sr,\ deck}$	kN	6.0		8.5		14.0	13.0	17.1		Not Permitted				
Factored pullout resistance in 20 MPa uncracked concrete	$N_{pr,\ uncr}$	kN	7.8		N/A		17.1	N/A	28.4		25.7		33.2		D.6.3.2
Factored pullout resistance in 20 MPa cracked concrete	$N_{pr,\ cr}$	kN	7.1		N/A		15.3	N/A			N/A				D.6.3.2
20 MPa cracked concrete	$N_{pr,deck\ cr}$	kN	4.5		4.5		8.1	6.2	14.4		Not Permitted				D.6.3.2

1 For more information, please visit www.hilti.ca and navigate Service/Downloads, then Technical Downloads and open the Limit States Design Guide.

KWIK Bolt TZ Expansion Anchor 3.3.4

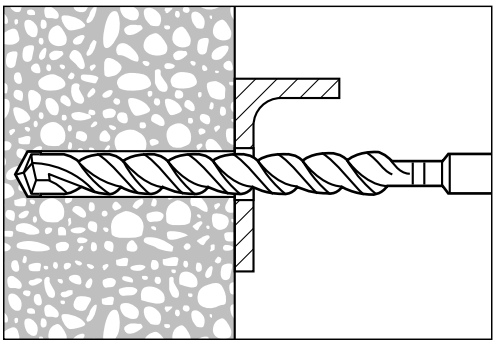
TABLE 13 - KWIK Bolt RTZ Design Information in accordance with CSA A23.3-04 Annex D[1]

Design Parameter	Symbol	Units	Nominal anchor diameter												Ref.
			3/8		1/2				5/8			3/4			A23.3-04
Anchor O.D.	d_o	mm	9.5		12.7				15.9			19.1			
		(in.)	0.375		0.5				0.625			0.75			
Effective min. embedment depth	$h_{ef,\,min}$	mm	51		51		83		79	102		95		121	
		(in.)	2		2		3-1/4		3-1/8	4		3-3/4		4-3/4	
Min. member thickness	h_{min}	mm	102	127	102	152	152	203	127	152	203	152	203	203	
Critical edge distance	c_{ac}	mm	111	98	140	114	191	152	178	225	152	254	178	229	
Minimum edge distance	c_{ac}	mm	64		73		54		83	60		108		102	
	for s >	mm	127		146		133		140	140		254		216	
Minimum anchor spacing	s_{min}	mm	57		73		51		70	60		127		102	
	for c >	mm	89		114		83		105	108		241		178	
Minimum hole depth in concrete	h_o	mm	67		67		102		98	121		117		146	
Anchor category	1, 2 or 3		1												D.5.4c
Concrete material resistance factor for concrete	ϕ_c		0.65												8.4.2
Steel embedment material resistance factor for reinforcement	ϕ_s		0.85												8.4.3
Strength reduction factor for tension, steel failure modes	R		0.80												D.5.4a
Strength reduction factor for shear, steel failure modes	R		0.75												D.5.4a
Strength reduction factor for tension, concrete failure modes	R	Cond. A	1.15												D.5.4c
	R	Cond. B	1.00												D.5.4c
Strength reduction factor for shear, concrete failure modes	R	Cond. A	1.15												D.5.4c
	R	Cond. B	1.00												D.5.4c
Yield strength of anchor steel	f_y	MPa	634		634				634			525			
Ultimate strength of anchor steel	f_{ut}	MPa	793		793				793			700			
Effective cross-sectional area	A_{se}	mm^2	33.6		65.0				104.6			152.8			
Coefficient for factored concrete breakout resistance in tension	k		7		10		7		7			10		7	D.6.2.6
Modification factor for resistance in tension to account for uncracked concrete	$\psi_{c,N}$		1.40		1.00		1.40		1.40			1.00		1.40	D.6.2.6
Factored Steel Resistance in tension	N_{sr}	kN	18.1		35.1				56.4			72.7			D.6.1.2
Factored Steel Resistance in shear	V_{sr}	kN	13.8		19.5				33.6			56.9			D.7.1.2c
Factored Steel Resistance in shear, seismic	$V_{sr,\,seismic}$	kN	8.0		19.5				33.6			41.4			
Factored pullout resistance in 20 MPa uncracked concrete	$N_{pr,\,cr}$	kN	8.2		N/A		17.9		N/A			N/A		37.4	D.6.3.2
Factored pullout resistance in 20 MPa cracked concrete	$N_{pr,\,cr}$	kN	7.3		9.9		N/A		N/A	18.1		25.2	N/A		D.6.3.2

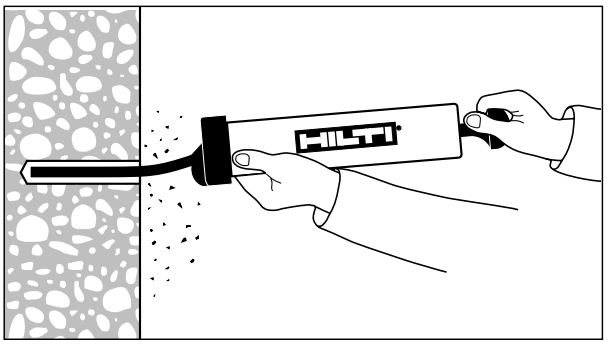
1 For more information, please visit www.hilti.ca and navigate Service/Downloads, then Technical Downloads and open the Limit States Design Guide.

3.3.4 KWIK Bolt TZ Expansion Anchor

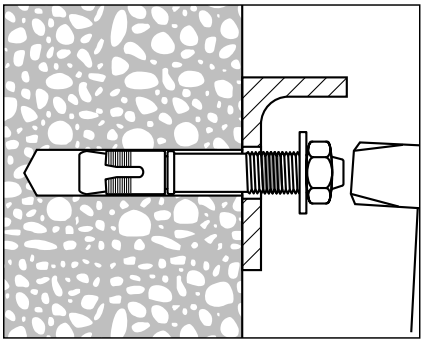
3.3.4.4 KWIK Bolt TZ Anchor Installation Instructions into normal-weight and lightweight concrete



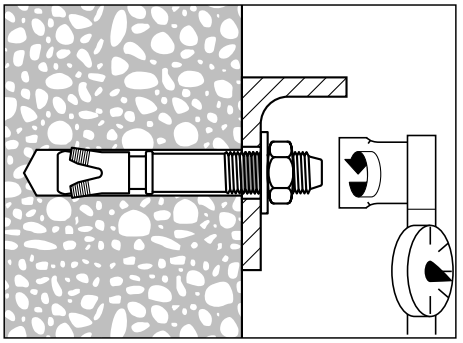
1. Hammer drill a hole to the same nominal diameter as the KWIK Bolt TZ. The minimum hole depth must conform with the instructions for use adhered to the packaging and the ICC-ES evaluation report, if applicable. The fixture may be used as a drilling template to ensure proper anchor location.



2. Clean hole.



3. Drive the KWIK Bolt TZ into the hole using a hammer. The anchor must be driven until at least 4 threads are below the surface of the fixture.



4. Tighten the nut to the installation torque.

3.3.4.5 KWIK Bolt TZ Anchor Ordering Information

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