

# APPENDIX B: Strength Design Performance values in accordance to 2006 IBC

## ITW RED HEAD TRUBOLT WEDGE ANCHOR

### DESIGN INFORMATION TESTED TO ICC-ES AC193 AND ACI 355.2, IN ACCORDANCE WITH 2006 IBC

**Trubolt®**  
Wedge Anchors

#### TRUBOLT WEDGE ANCHOR DESIGN INFORMATION<sup>1,2,3</sup>

DESIGN INFORMATION	Symbol	Units	Nominal Anchor Diameter									
			1/4		3/8		1/2		5/8		3/4	
Anchor O.D.	$d_o$	in	0.250		0.375		0.500		0.625		0.750	
Effective embedment	$h_{ef}$	in	1-1/2	2	1-3/4	2-5/8	1-7/8	3-3/8	2-1/2	4	3-1/2	4-3/4
Minimum member thickness	$h_{min}$	in	4	4	4	5	5	6	5	8	6	8
Critical edge distance	$c_{ac}$	in	2-5/8	3	2-5/8	5-1/4	3-3/4	6-3/4	5	8	7	9
Minimum edge distance	$c_{min}$	in	1-3/4	1-1/2	2-1/4	2	3-3/4	3-3/4	4-1/4	3-1/4	3-3/4	3-1/2
Minimum anchor spacing	$s_{min}$	in	1-3/4	1-1/2	2-1/4	2	3-3/4	3-3/4	4-1/4	3-1/4	3-3/4	3-1/2
Min. Specified Yield Strength	$f_y$	lb/in <sup>2</sup>	55,000									
Min. Specified Ultimate Strength	$f_{uta}$	lb/in <sup>2</sup>	75,000									
Effective tensile stress area	$A_{se}$	in <sup>2</sup>	0.032		0.078		0.142		0.226		0.334	
Steel strength in tension	$N_s$	lb	2,385		5,815		10,645		16,950		25,050	
Steel strength in shear	$V_s$	lb	1,430		2,975	3,490	4,450	6,385	6,045	10,170	10,990	15,030
Pullout strength, uncracked concrete	$N_{p,uncr}$	lb	1,392	1,706	2,198	3,469	2,400	4,168	4,155	6,638	8,031	10,561
Anchor Category (All anchors are ductile)			1									
Effectiveness factor $k_{uncr}$ uncracked concrete			24									
Axial stiffness in service load range	$\beta$	lb/in	14,651	9,385	17,515	26,424	32,483	26,136	42,899	21,749	43,576	28,697
Coefficient for variation for axial stiffness in service load range			34	47	28	45	17	33	55	22	63	28
Strength reduction factor $\phi$ for tension, steel failure modes			0.75									
Strength reduction factor $\phi$ for shear, steel failure modes			0.65									
Strength reduction factor $\phi$ for tension, concrete failure modes, Condition B			0.65									
Strength reduction factor $\phi$ for shear, concrete failure modes, Condition B			0.70									

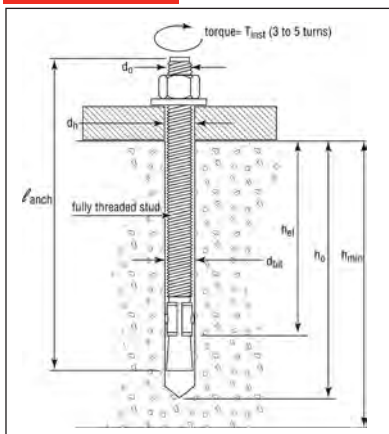
<sup>1</sup> Trubolt+ Anchor Design Strengths must be determined in accordance with ACI 318-05 Appendix D and this table

<sup>2</sup> The Trubolt+ Wedge Anchor is a ductile steel element as defined by ACI 318 D.1

<sup>3</sup> 1/4", 3/8", & 1/2" diameter data is listed in ICC-ES ESR-2251.

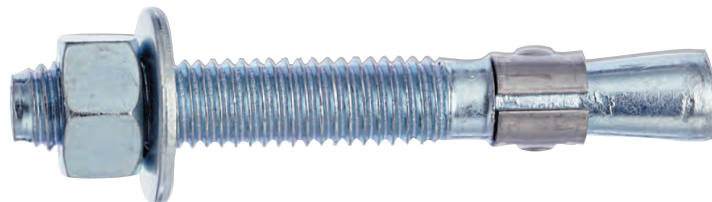
**Trubolt®**  
Wedge Anchors

#### TRUBOLT WEDGE ANCHOR (INSTALLED)



#### TRUBOLT WEDGE INSTALLATION INFORMATION

	Symbol	Units	Nominal Anchor Diameter (in.)									
			1/4		3/8		1/2		5/8		3/4	
Anchor outer diameter	$d_o$	in	0.25		0.375		0.5		0.625		0.750	
Nominal carbide bit diameter	$d_{bit}$	in	1/4		3/8		1/2		5/8		3/4	
Effective embedment depth	$h_{ef}$	in	1-1/2	2	1-3/4	2-5/8	1-7/8	3-3/8	2-1/2	4	3-1/2	4-3/4
Min hole depth	$h_o$	in	2	2-1/2	2-1/2	3-3/8	2-3/4	4-1/4	3-3/4	5-1/4	4-3/4	6
Min slab thickness	$h_{min}$	in	4	4	5	5	6	5	8	6	8	
Installation torque	$T_{inst}$	ft-lb	4		25		55		90		110	
Min hole diameter in fixture	$d_h$	in	5/16		7/16		9/16		11/16		13/16	



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## TRUBOLT WEDGE PULLOUT STRENGTH ( $N_p, unc$ ) (POUNDS) <sup>1</sup>

Nominal Anchor Diameter (in.)	Effective Embedment Depth (in.)	Concrete Compressive Strength			
		f'c = 2,500 psi	f'c = 3,000 psi	f'c = 4,000 psi	f'c = 6,500 psi
1/4	1-1/2	1,392	1,525	1,610	1,822
	2	1,706	1,869	1,947	2,151
3/8	1-3/4	2,198	2,408	2,621	3,153
	2-5/8	3,469	3,800	3,936	4,275
1/2	1-7/8	2,400	2,629	3,172	4,520
	3-3/8	4,168	4,520	4,520	4,520
5/8	2-1/2	4,155	4,155	4,376	5,578
	4	6,638	6,900	7,968	10,157
3/4	3-1/2	8,031	8,322	9,610	12,251
	4-3/4	10,561	10,561	10,561	12,251

For SI: 1 inch = 25.4 mm, 1 lbf = 4.45 N, 1 psi = 0.006895 Mpa

<sup>1</sup> Values are for single anchors with no edge distance or spacing reduction.

## TRUBOLT WEDGE ANCHOR ALLOWABLE STATIC TENSION (ASD), NORMAL-WEIGHT UNCRACKED CONCRETE <sup>1-6</sup>

Nominal Anchor Diameter (in.)	Effective Embedment Depth (in.)	Concrete Compressive Strength			
		f'c = 2,500 psi	f'c = 3,000 psi	f'c = 4,000 psi	f'c = 6,500 psi
1/4	1-1/2	611	670	707	800
	2	749	821	855	945
3/8	1-3/4	965	1,058	1,151	1,385
	2-5/8	1,524	1,669	1,729	1,878
1/2	1-7/8	1,054	1,155	1,393	1,985
	3-3/8	1,831	1,985	1,985	1,985
5/8	2-1/2	1,825	1,825	1,922	2,450
	4	2,915	3,030	3,499	4,461
3/4	3-1/2	3,527	3,655	4,221	5,381
	4-3/4	4,638	4,638	4,638	5,381

For SI: 1 inch = 25.4 mm, 1 lbf = 4.45 N, 1 psi = 0.006895 Mpa

Design Assumptions:

- <sup>1</sup> Single anchor with static tension load only.
- <sup>2</sup> Concrete determined to remain uncracked for the life of the anchorage.
- <sup>3</sup> Load combinations from 2006 IBC, Sections 1605.2.1 and 1605.3.1 (no seismic loading).
- <sup>4</sup> Thirty percent dead load and 70 percent live load, controlling load combination 1.2D + 1.6L
- <sup>5</sup> Calculation of weighted average: 1.2D + 1.6L = 1.2 (0.3) + 1.6 (0.7) = 1.48
- <sup>6</sup> Values do not include edge distance or spacing reductions.



## TRUBOLT WEDGE ANCHOR ALLOWABLE STATIC SHEAR (ASD), STEEL (POUNDS)<sup>1-5</sup>

Nominal Anchor Diameter (in.)	Effective Embedment Depth (in.)	Allowable Steel Capacity, Static Shear
1/4	1-1/2	628
	2	
3/8	1-3/4	1,307
	2-5/8	1,533
1/2	1-7/8	1,954
	3-3/8	2,804
5/8	2-1/2	2,655
	4	4,467
3/4	3-1/2	4,827
	4-3/4	6,601

For SI: 1 inch = 25.4 mm, 1 lbf = 4.45 N, 1 psi = 0.006895 Mpa

Design Assumptions:

- <sup>1</sup> Single anchor with static shear load only.
- <sup>3</sup> Load combinations from 2006 IBC, Sections 1605.2.1 and 1605.3.1 (no seismic loading).
- <sup>3</sup> Thirty percent dead load and 70 percent live load, controlling load combination 1.2D + 1.6L
- <sup>4</sup> Calculation of weighted average: 1.2D + 1.6L = 1.2 (0.3) + 1.6 (0.7) = 1.48
- <sup>5</sup> Values do not include edge distance or spacing reductions.