BRIGHTON-BEST INTERNATIONAL, INC.
U.S. ANCHOR ULTRAWEDGE+ WEDGE ANCHORS
COMPETITIVE COMPARISONS

INTRODUCTION

Comparisons of performance items are provided for similar wedge anchors made by several competitors. The performance items were taken from published ICC Evaluation Service (ICC-ES) Evaluation Service reports for each product listed in the following table.

TABLE 1

Product	Report Holder	Report Number	Report Date
Ultrawedge+	Brighton Best, Inc.	ESR-3981	August 2021
Kwik Bolt TZ	Hilti	ESR-1917	May 2021
Strong-Bolt 2	Simpson Strong-Tie	ESR-3037	August 2021
Power-Stud+ SD1	Dewalt	ESR-2818	September 2021

The following performance items are compared for each product in the following tables.

- Tension resistance (pull-out or concrete breakout as applicable), in uncracked and cracked concrete
- Minimum concrete thickness (h_{min}) and critical edge distance (c_{ac})
- Minimum edge distance, (c_{min}) and minimum spacing distance (s_{min})

It is noted that all products are Anchor Category 1 which determines the applicable Φ factor to calculate the final design value.

The following table provides the nominal embedment (h_{nom}) for each product and anchor diameter used for the comparison. The closest embedments to those of the Ultrawedge+ for each size were used for the other products.

TABLE 2

Product	Minimum Embedment, h_{nom} [1], inches			
	3/8	1/2	5/8	3/4
Ultrawedge+	2 3/8	3	3 9/16	4 1/8
Kwik Bolt TZ	2 5/16	2 3/8	3 9/16	3 13/16
Strong-Bolt 2	2 7/8	2 3/4	3 3/8	4 1/8
Power-Stud+ SD1	2 3/8	2 1/2	3 3/8	4

[1] h_{nom} is the distance from the concrete surface to the embedded end of the anchor before tightening

BRIGHTON-BEST INTERNATIONAL, INC.
U.S. ANCHOR ULTRAWEDGE+ WEDGE ANCHORS
COMPETITIVE COMPARISONS

TENSION RESISTANCE

Tension resistance may be based on pull-out or concrete breakout. The ESRs publish actual values in the data tables when pull-out resistance ($N_{p.uncr}$ or $N_{p.cr}$) is determined to be the failure mode based on the qualification testing. This indicates that the test results did not meet the requirements for concrete breakout. When test results indicate that requirements for concrete breakout are met, "N/A" is shown in the data tables. This means that the tension resistance must be calculated in accordance with ACI 318-14 Section 17.4.2. For the purpose of the comparisons in this document, ACI 318-14 Equation (17.4.2.2a) is used to calculate the basic concrete breakout resistance (N_b) of a single anchor and the resulting values are listed in the following table for each anchor diameter.

TABLE 3 [1]

Product	Tension Resistance, Uncracked, lbs.				Tension Resistance, Cracked, lbs.			
	3/8	1/2	5/8	3/4	3/8	1/2	5/8	3/4
Ultrawedge+	3013	3394	7014	8840	2404	2970	4037	7857
Kwik Bolt TZ	2515	3394	6629	7031	2270	2404	4696	4980
Strong-Bolt 2	3340	3615	5472	7115	2775	2869	3876	5270
Power-Stud+ SD1	2865	3220	5472	6629	2035	2404	3876	4696

[1] Values are based on 2500 psi concrete strength and may be increased for higher strengths per ESR provisions

MINIMUM CONCRETE THICKNESS AND CRITICAL EDGE DISTANCE

Critical edge distance (c_{ac}) is the distance from the concrete edge required to develop the concrete breakout strength of an anchor installation. For installations less than c_{ac}, reduction to the tension resistance is required in accordance with ACI-318 requirements as modified by ESR provisions. Critical edge distance is dependent on the concrete thickness since less thickness generally requires greater critical edge distance. Edge and spacing distances are also dependent on the minimum concrete thickness so the comparison must also consider the minimum concrete thickness.

The following table provides the minimum concrete thicknesses and the related critical edge distances for each anchor diameter.

TABLE 4

Product	Minimum Concrete Thickness, h_{min}, inches				Critical Edge Distance, c_{ac}, inches			
	3/8	1/2	5/8	3/4	3/8	1/2	5/8	3/4
Ultrawedge+	4 1/2	6	6 1/2	6 1/2	8	8	13	11
	6				5			
Kwik Bolt TZ	4	4	5	5 1/2	4 3/8	5 1/2	6 1/2	12
	5	6			4	4 1/2		
Strong-Bolt 2	4 1/2	4	6	6	6	6	7 1/2	6
		5 1/2	6	6 3/4		6	7 1/2	6
Power-Stud+ SD1	3 3/4	4	6	6	6 1/2	8	6	11
	4				6 1/2			

MINIMUM EDGE AND SPACING DISTANCES

As noted in the **MINIMUM CONCRETE THICKNESS AND CRITICAL EDGE DISTANCE** section above, the minimum edge and spacing distances (c_{min} and s_{min}) and the critical edge distance (c_{ac}) are dependent on the minimum concrete thickness (h_{min}). The following tables provide the minimum edge and spacing distances that are related to the combinations of minimum concrete thicknesses and critical edge distances for each anchor diameter.

For most of the anchor diameters there are two combinations of minimum edge and spacing distances that are related to the given minimum concrete thicknesses and critical edge distances:

- Minimum edge distance requiring greater spacing distance
- Minimum spacing distance for a greater edge distance

The steps to use the tables for an installation are:

- Select the minimum concrete thickness that applies. If the installation thickness is greater than the larger thickness in the table, use the edge and spacing distances related to the larger thickness in the table.
- Select the edge and spacing distance combinations that reflect the installation conditions. If the edge distance is greater than the larger distance, use the related minimum spacing distance.
- For an installation in 7” concrete thickness and edge distance of 5”, spacing could be 2 1/2” or more for the 3/8”, Ultrawedge+. For an installation in 7” concrete thickness and edge distance of 3”, spacing of 5” or more is required. See Table 5 for the Ultrawedge+ minimum distances for 6” minimum concrete thickness used for the installation conditions in these examples.
- Determination of load reductions from values in Table 3 for edge distances, spacing and other parameters must be in accordance with ACI 318-14 requirements as modified by ESR provisions and is beyond the scope of this document.
- Higher values in Table 3 will generally in result higher values when load reductions for edge and spacing distances are applied so comparison of the basic tension resistance values is an important consideration when comparing product performance.

BRIGHTON-BEST INTERNATIONAL, INC.
U.S. ANCHOR ULTRAWEDGE+ WEDGE ANCHORS
COMPETITIVE COMPARISONS

TABLE 5 – 3/8”

Product	h_{min}	c_{ac}	Minimum Distances for Anchor Size, inches	
			Edge, c_{min}	Spacing, s_{min}
			3/8	
Ultrawedge+	4 1/2	8	4	≥6
			≥4	6
	6	5	2 1/2	≥5
			≥4	2 1/2
Kwik Bolt TZ	4	4 3/8	2 1/2	≥5
			≥3 5/8	2 1/2
	5	4	2 1/2	≥5
			≥3 5/8	2 1/2
Strong-Bolt 2	4 1/2	6	6	≥3
Power-Stud+ SD1	3 3/4	6 1/2	2 3/4	≥9
			≥6	3 1/2
	4	6 1/2	2 1/4	≥3 3/4

TABLE 6 – 1/2”

Product	h_{min}	c_{ac}	Minimum Distances for Anchor Size, inches	
			Edge, c_{min}	Spacing, s_{min}
			1/2	
Ultrawedge+	6	8	2 3/4	≥6
			≥4	3
Kwik Bolt TZ	4	5 1/2	2 3/4	≥5 3/4
			≥4 1/8	2 3/4
	6	4 1/2	2 3/4	≥5 3/4
			≥4 1/8	2 3/4
Strong-Bolt 2	4	6	6	≥6
			≥12	2 3/4
	5 1/2	6	6	≥6
			≥12	2 3/4
Power-Stud+ SD1	4	8	3 1/4	≥10
			≥6	4 1/2

BRIGHTON-BEST INTERNATIONAL, INC.
U.S. ANCHOR ULTRAWEDGE+ WEDGE ANCHORS
COMPETITIVE COMPARISONS

TABLE 7 – 5/8”

Product	h_{min}	c_{ac}	Minimum Distances for Anchor Size, inches	
			Edge, c_{min}	Spacing, s_{min}
			5/8	
Ultrawedge+	6 1/2	13	4	≥6
			≥6	3 3/4
Kwik Bolt TZ	5	6 1/2	3 5/8	≥6 1/8
			≥4 3/4	3 1/2
Strong-Bolt 2	5 1/2	7 1/2	6 1/2	≥5
	6	7 1/2	6 1/2	≥5
			≥8	2 3/4
Power-Stud+ SD1	6	6	5 1/2	≥11
			≥6	6

TABLE 8 – 3/4”

Product	h_{min}	c_{ac}	Minimum Distances for Anchor Size, inches	
			Edge, c_{min}	Spacing, s_{min}
			3/4	
Ultrawedge+	6 1/2	11	5	≥9
			≥9	5
Kwik Bolt TZ	5 1/2	12	9 1/2	≥5
			≥9 1/2	5
Strong-Bolt 2	6	6	4 1/4	≥10
			≥6	3 1/2
	6 3/4	6	6 1/2	≥8
			≥6	3 1/2
Power-Stud+ SD1	6	11	5	≥6