

# ABR/AE/E

## Angle Brackets for Cross-Laminated Timber (CLT)

ABR, AE and E angle brackets are used to connect cross-laminated timber (CLT) wall panels to CLT floors or concrete slabs. A wide variety of fastener and anchor options are available depending on the required loads and application.

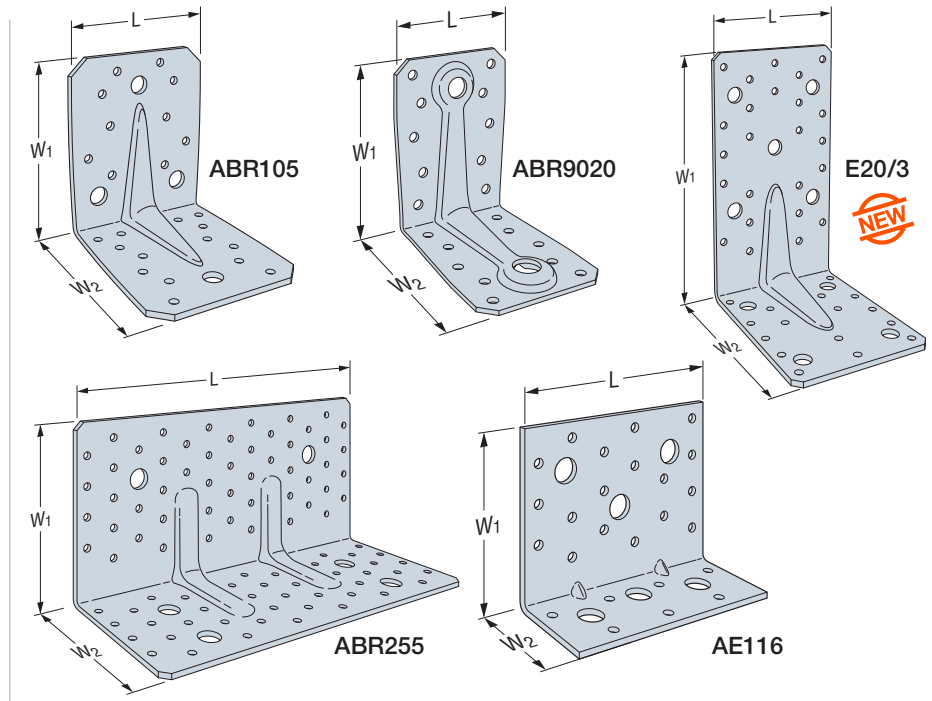
**Material:** ABR9020 — 14 gauge  
ABR105, AE116, ABR255,  
E20/3 — 11 gauge

**Finish:** Galvanized

**Installation:**

- Use all specified fasteners and anchors
- Follow installation images

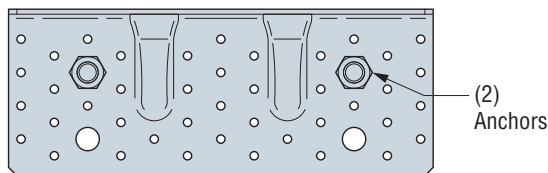
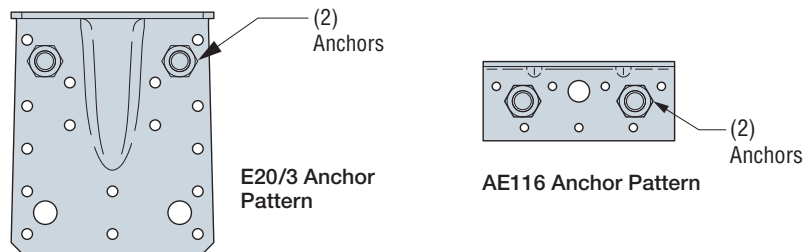
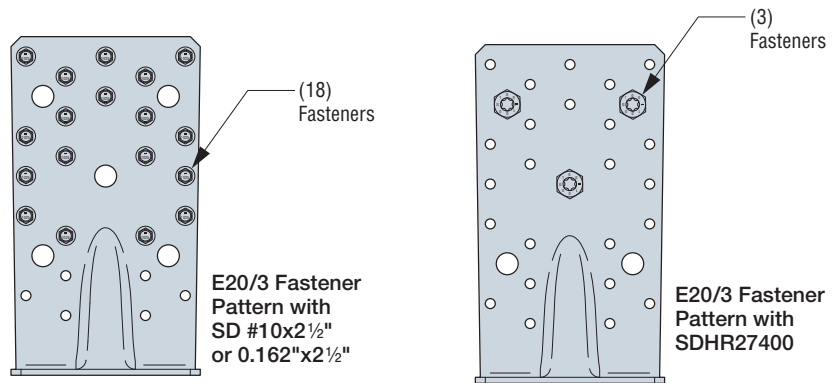
**Special Features:** The E20/3 angle bracket has been tested with up to a 2" gap between the bottom of the CLT wall and the top of concrete slab. This gap allows the wall to be separated with a pressure-treated sill plate, concrete curb, grout pad, or other specified material.



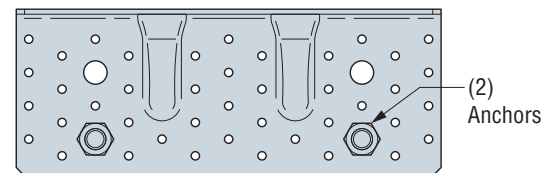
### Special Fastener and Anchor Patterns

### Angle Bracket Dimensions

Model No.	Gauge	Dimensions (in.)		
		W <sub>1</sub>	W <sub>2</sub>	L
ABR9020	14	3 <sup>7</sup> / <sub>16</sub>	3 <sup>7</sup> / <sub>16</sub>	2 <sup>9</sup> / <sub>16</sub>
ABR105	11	4 <sup>1</sup> / <sub>8</sub>	4 <sup>1</sup> / <sub>8</sub>	3 <sup>3</sup> / <sub>8</sub>
AE116	11	3 <sup>3</sup> / <sub>16</sub>	1 <sup>7</sup> / <sub>8</sub>	4 <sup>9</sup> / <sub>16</sub>
ABR255	11	4 <sup>3</sup> / <sub>4</sub>	3 <sup>15</sup> / <sub>16</sub>	10
E20/3	11	6 <sup>3</sup> / <sub>4</sub>	4 <sup>1</sup> / <sub>2</sub>	3 <sup>3</sup> / <sub>4</sub>



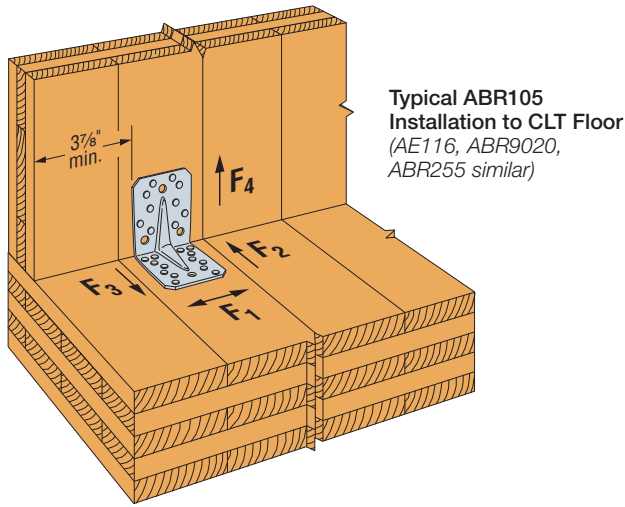
ABR255 Anchor Pattern — Option 1



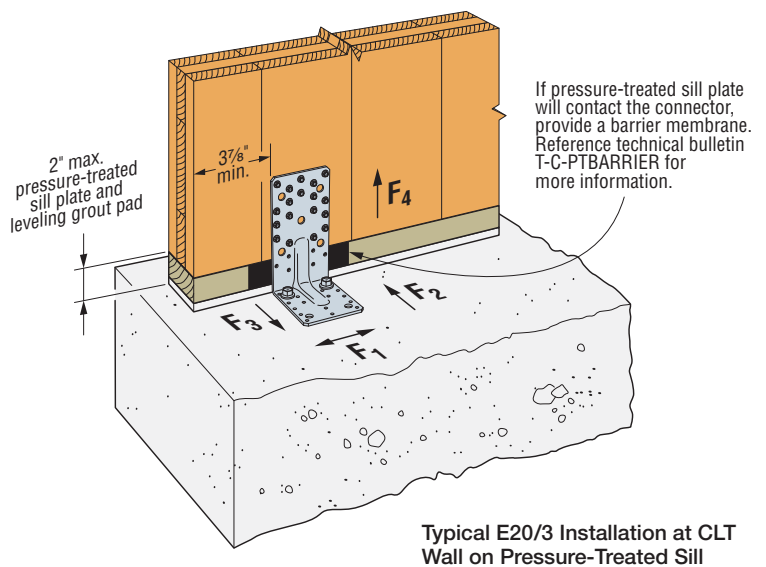
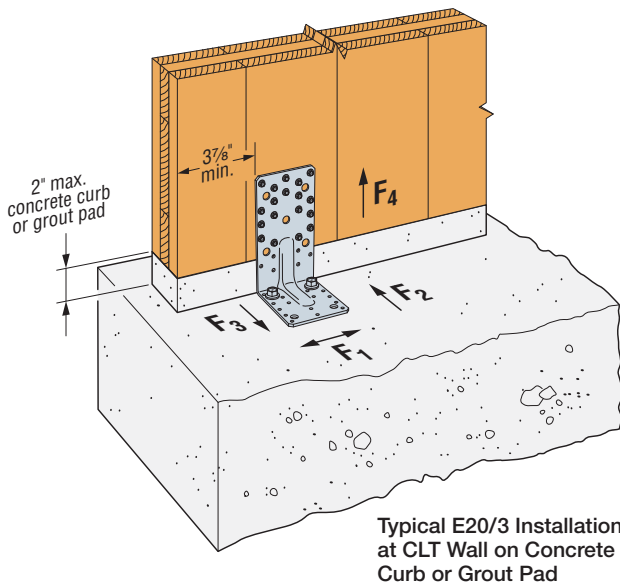
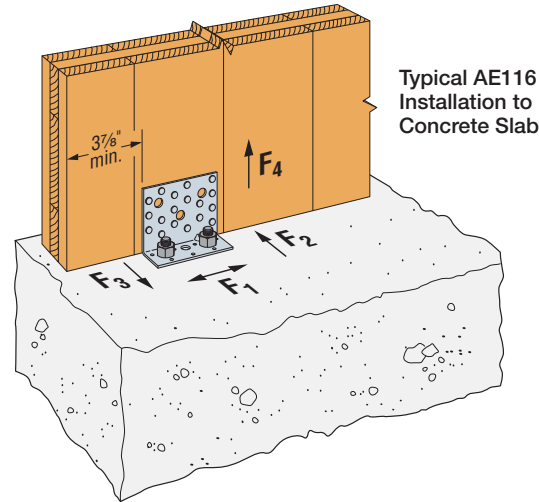
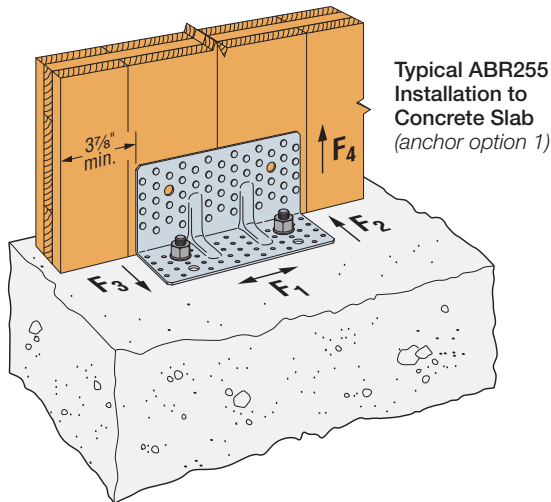
ABR255 Anchor Pattern — Option 2

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## Angle Brackets for Cross-Laminated Timber (CLT) (cont.)



### Anchorage to Concrete Options



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## Angle Brackets for Cross-Laminated Timber (CLT) (cont.)

### Allowable Loads — CLT Panel-to-Panel Connection

Model No.	Gauge	Dimensions (in.)			Fastener Schedule		Allowable Load (lb.) C <sub>D</sub> = 1.60			
		W <sub>1</sub>	W <sub>2</sub>	L	Horizontal Leg	Vertical Leg	F <sub>1</sub>	F <sub>2</sub>	F <sub>3</sub>	F <sub>4</sub>
ABR9020	14	3 <sup>7</sup> / <sub>16</sub>	3 <sup>7</sup> / <sub>16</sub>	2 <sup>9</sup> / <sub>16</sub>	(10) SD #10 x 2 1/2"	(10) SD #10 x 2 1/2"	1,480	1,200	1,330	1,010
					(10) 0.162" x 2 1/2"	(10) 0.162" x 2 1/2"	980	425	1,330	510
ABR105	11	4 <sup>1</sup> / <sub>8</sub>	4 <sup>1</sup> / <sub>8</sub>	3 <sup>9</sup> / <sub>16</sub>	(14) SD #10 x 2 1/2"	(10) SD #10 x 2 1/2"	1,880	1,235	2,300	1,475
					(14) 0.162" x 2 1/2"	(10) 0.162" x 2 1/2"	1,220	580	2,020	415
AE116	11	3 <sup>7</sup> / <sub>16</sub>	1 <sup>7</sup> / <sub>8</sub>	4 <sup>9</sup> / <sub>16</sub>	(7) SD #10 x 1 1/2"	(7) SD #10 x 1 1/2"	1,545	805	1,545	775
					(7) SD #10 x 2 1/2"	(18) SD #10 x 2 1/2"	1,850	1,445	1,850	1,035
					(7) 0.162" x 2 1/2"	(18) 0.162" x 2 1/2"	1,440	840	1,440	395
ABR255	11	4 <sup>3</sup> / <sub>4</sub>	3 <sup>15</sup> / <sub>16</sub>	10	(41) SD #10 x 2 1/2"	(52) SD #10 x 2 1/2"	3,805	4,430	3,165	3,970
					(41) 0.162" x 2 1/2"	(52) 0.162" x 2 1/2"	3,800	2,715	4,315	2,080

1. See table notes below.

### Allowable Loads — CLT Panel-to-Concrete Connection

Model No.	Gauge	Dimensions (in.)			Fastener Schedule		Allowable Load (lb.) C <sub>D</sub> = 1.60			
		W <sub>1</sub>	W <sub>2</sub>	L	Horizontal Leg	Vertical Leg	F <sub>1</sub>	F <sub>2</sub>	F <sub>3</sub>	F <sub>4</sub>
AE116	11	3 <sup>7</sup> / <sub>16</sub>	1 <sup>7</sup> / <sub>8</sub>	4 <sup>9</sup> / <sub>16</sub>	(2) 1/2" bolt	(18) SD #10 x 1 1/2"	1,845	1,080	2,730	1,905
					(2) 1/2" bolt	(18) SD #10 x 2 1/2"	3,765	1,445	3,175	1,905
					(2) 1/2" bolt	(18) 0.162" x 2 1/2"	2,565	1,030	3,085	2,310
ABR255	11	4 <sup>3</sup> / <sub>4</sub>	3 <sup>15</sup> / <sub>16</sub>	10	Anchor Option 1 — (2) 1/2" bolt	(52) 0.162" x 2 1/2"	3,910	2,505	3,605	2,475
					Anchor Option 2 — (2) 1/2" bolt	(52) 0.162" x 2 1/2"	3,805	2,505	3,885	1,080
E20/3	11	6 <sup>3</sup> / <sub>4</sub>	4 <sup>1</sup> / <sub>2</sub>	3 <sup>3</sup> / <sub>4</sub>	(2) 3/8" bolt	(18) SD #10 x 2 1/2"	1,565	790	700	1,885
					(2) 3/8" bolt	(18) 0.162" x 2 1/2"	1,625	610	725	1,835
					(2) 3/8" bolt	(3) SDHR27400	705	360	860	1,865

**For SI:** 1 inch = 25.4 mm; 1 lbf = 4.45 N.

- The allowable loads are based on the use of SPF Grade 2 cross-laminated timber (CLT) material conforming to APA PRG-320.
- Installation and fastener schedule in "CLT Panel to Panel Connection" table assumes platform framing, i.e., install vertical leg at bottom edge of CLT wall panel, and horizontal leg on CLT floor panel with 3<sup>7</sup>/<sub>16</sub> in. min. edge distance.
- Allowable loads have been increased for wind or earthquake loading with no further increase allowed. Reduce for other load durations as required by code.
- The designer must specify the anchor bolt type, length, and embedment. Allowable load shall be taken as lower of anchorage capacity per designer and table load. See next page for Titen HD Anchorage Values.
- See Engineering Letter L-C-CLTABSDPWS for F<sub>1</sub> loads calculated in accordance with Special Design Provisions for Wind and Seismic 2021 (SDPWS2021)
- Nails:** 0.162" x 2 1/2" = 0.162 in. diameter x 2.5 in. long.
- Screws:** SD10 x 1 1/2" and SD#10 x 2 1/2" = 0.162 in. shank diameter x 1.5 in. long and 2.5 in. long Simpson Strong-Drive® SD Connector screw respectively. SDHR27400 = 0.275 in. shank diameter x 4 in. long Simpson Strong-Drive® SDHR Combo-Head screw.

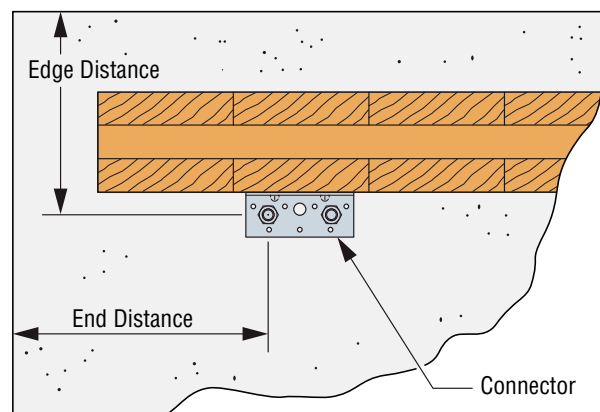
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## Angle Brackets for Cross-Laminated Timber (CLT) (cont.)

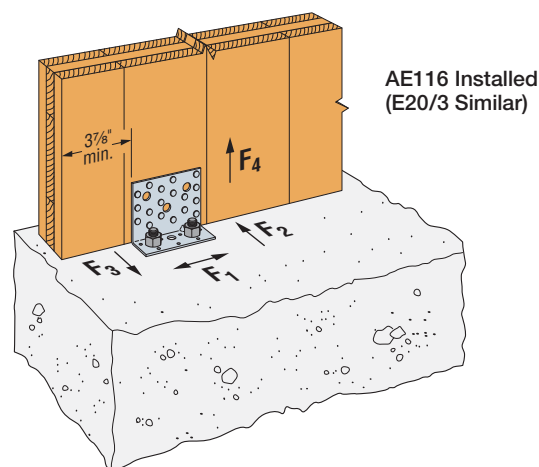
### Allowable Loads — Titen HD® Anchorage Values

Model No.	Anchor	Min. Concrete Thickness (in.)	Min. Edge Distance (in.)	Min. End Distance (in.)	Allowable Load (lb.)			
					F <sub>1</sub>	F <sub>2</sub>	F <sub>3</sub>	F <sub>4</sub>
<b>Uncracked Concrete, Wind &amp; Seismic in SDC A&amp;B</b>								
AE116	(2) THD50400H	6	5	10	2,765	3,025	5,370	1,685
			5	24	5,260	3,025	5,370	1,685
E20/3	(2) THD37300H	4½	5	10	2,505	2,240	2,505	1,820
			5	24	2,505	2,240	2,505	1,820
	(2) THD37400H	5½	5	10	2,360	2,570	3,175	2,300
			5	24	3,175	2,570	3,175	2,300
<b>Cracked Concrete, Wind &amp; Seismic in SDC A&amp;B</b>								
AE116	(2) THD50400H	6	5	10	1,975	2,160	5,370	1,350
			5	24	3,755	2,160	5,370	1,350
E20/3	(2) THD37300H	4½	5	10	1,465	1,600	1,775	1,300
			5	24	1,775	1,600	1,775	1,300
	(2) THD37400H	5½	5	10	1,685	1,835	2,250	1,640
			5	24	2,250	1,835	2,250	1,640
<b>Uncracked Concrete, Seismic in SDC C-F</b>								
AE116	(2) THD50400H	6	5	10	2,305	2,520	4,025	1,450
			5	24	4,025	2,520	4,025	1,450
E20/3	(2) THD37300H	4½	5	10	1,710	1,865	2,070	1,140
			5	24	2,070	1,865	2,070	1,140
	(2) THD37400H	5½	5	10	1,965	2,145	2,400	1,435
			5	24	2,400	2,145	2,400	1,435

1. Allowable anchor capacities have been determined using ACI318-14 Chapter 17 calculations with a minimum concrete compressive strength ( $f'c$ ) of 4,000 psi in normal weight concrete.
2. Load values are for group anchors based on ACI318, Condition B, no supplemental edge reinforcement,  $\psi_c V = 1.0$  for cracked concrete and periodic inspection.
3. Allowable Stress Design (ASD) values were determined by multiplying the LRFD capacities by a conversion factor, Alpha ( $\alpha$ ), of 0.7 for seismic and 0.6 of wind loads.
4. Tabulated allowable ASD loads for Wind and Seismic in SDC A&B are based on a wind conversion factor and may be increased by 1.17 for SDC A&B only.
5. Design loads shall include seismic overstrength factor per ASCE7 Section 12.4.3, as required.
6. Allowable load shall be taken as lower of anchorage capacity or the connector capacity. Anchors subjected to both tension and shear loads shall be evaluated per ACI318 Section 17.6.
7. Anchors: THD50400H = ½" diameter x 4" long Titen HD® Heavy-Duty Screw Anchor. THD37300 and THD37400 = ¾" diameter x 3" long and 4" long, respectively, Titen HD Heavy-Duty Screw Anchor.



Anchor Edge and End Distance



AE116 Installed (E20/3 Similar)