Wall Tension Ties

PAI/MPAI Purlin Anchors
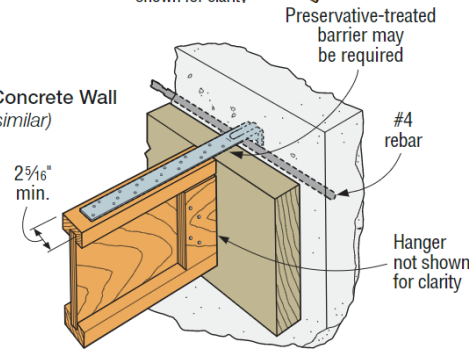
Max Ledger Size	Model No.	Strap Length, L (in.)	Embed Length, l_e (in.)		Uncracked Concrete		Cracked Concrete		GFCMU Wall		Max. Allowable Strap Tension	Deflection at Allowable Load (in.)	Code Ref.
			Concrete	GFCMU	Required Nails (in.)	Tension	Required Nails (in.)	Tension	Required Nails (in.)	Tension			
					Wind and SDC A&B – Allowable Tension Loads (160)								
4x Ledger	PA18	18½	4	6	(12) 0.148 x 3	2,430	(12) 0.148 x 3	2,260	(12) 0.148 x 3	1,890	NA	0.087	IBC, FL
	PAI18	18	4	6	(10) 0.148 x 1½	2,025	(10) 0.148 x 1½	2,025	(9) 0.148 x 1½	1,055	NA	0.1	
	PA23	23¾	4	6	(16) 0.148 x 3	3,220	(12) 0.148 x 3	2,260	(16) 0.148 x 3	2,815	NA	0.118	
	PAI23	23	4	6	(15) 0.148 x 1½	3,035	(12) 0.148 x 1½	2,260	(14) 0.148 x 1½	1,805	NA	0.158	
	PA28	29	4	6	(16) 0.148 x 3	3,230	(12) 0.148 x 3	2,260	(16) 0.148 x 3	2,815	NA	0.085	
	PAI28	29	4	6	(16) 0.148 x 1½	3,230	(12) 0.148 x 1½	2,260	(16) 0.148 x 1½	2,705	NA	0.167	
	PA35	35	4	6	(16) 0.148 x 3	3,230	(12) 0.148 x 3	2,260	(16) 0.148 x 3	2,815	NA	0.085	
	PAI35	35	4	6	(16) 0.148 x 1½	3,230	(12) 0.148 x 1½	2,260	(18) 0.148 x 1½	2,815	NA	0.13	
	MPAI32	33½	5½		(16) 0.148 x 1½	2,885	(16) 0.148 x 1½	2,885	(16) 0.148 x 1½	2,355	NA	0.167	
	MPAI44	45½	5½		(16) 0.148 x 1½	2,885	(16) 0.148 x 1½	2,885	(24) 0.148 x 1½	2,865	NA	0.167	
	HPA28	32½	6	6	(22) 0.148 x 3	5,145	(20) 0.148 x 3	4,675	—	—	NA	0.133	
	HPA35	38½	8¼	8¼	(22) 0.148 x 3	5,145	(22) 0.148 x 3	5,145	—	—	NA	0.132	
					SDC C–F – Allowable Tension Loads (160)								
4x Ledger	PA18	18½	4	6	(12) 0.148 x 3	2,430	(10) 0.148 x 3	1,980	(12) 0.148 x 3	1,890	3,220	0.087	IBC, FL
	PAI18	18	4	6	(10) 0.148 x 1½	2,025	(10) 0.148 x 1½	1,980	(9) 0.148 x 1½	1,055	4,180	0.1	
	PA23	23¾	4	6	(14) 0.148 x 3	2,830	(10) 0.148 x 3	1,980	(16) 0.148 x 3	2,815	3,220	0.118	
	PAI23	23	4	6	(14) 0.148 x 1½	2,830	(10) 0.148 x 1½	1,980	(14) 0.148 x 1½	1,805	4,180	0.158	
	PA28	29	4	6	(14) 0.148 x 3	2,830	(10) 0.148 x 3	1,980	(16) 0.148 x 3	2,815	3,935	0.085	
	PAI28	29	4	6	(14) 0.148 x 1½	2,830	(10) 0.148 x 1½	1,980	(16) 0.148 x 1½	2,705	5,070	0.167	
	PA35	35	4	6	(14) 0.148 x 3	2,830	(10) 0.148 x 3	1,980	(16) 0.148 x 3	2,815	3,935	0.085	
	PAI35	35	4	6	(14) 0.148 x 1½	2,830	(10) 0.148 x 1½	1,980	(18) 0.148 x 1½	2,815	5,070	0.13	
	MPAI32	33½	5½		(16) 0.148 x 1½	2,885	(16) 0.148 x 1½	2,885	(16) 0.148 x 1½	2,355	3,205	0.167	
	MPAI44	45½	5½		(16) 0.148 x 1½	2,885	(16) 0.148 x 1½	2,885	(24) 0.148 x 1½	2,865	3,205	0.167	
	HPA28	32½	6	6	(22) 0.148 x 3	5,145	(18) 0.148 x 3	4,090	—	—	5,145	0.133	
	HPA35	38½	8¼	8¼	(22) 0.148 x 3	5,145	(22) 0.148 x 3	5,145	—	—	5,145	0.132	

[1] Allowable loads have been increased for wind or earthquake loading with no further increase allowed. Reduce where other loads govern.
[2] Deflection listed is at the highest allowable load.
[3] Multiply Seismic and Wind ASD load values by 1.43 or 1.67, respectively, to obtain LRFD capacities.
[4] Nail quantities are based on Douglas fir (DF) or equivalent specific gravity of 0.50 or better. For use in spruce-pine-fir (SPF) or hem-fir (HF), nail quantities shall be increased by 1.15 to achieve loads listed.
[5] For wall anchorage systems in SDC C-F, the maximum strap allowable load shall not be less than 1.4 times the ASD anchor design load.
[6] Minimum center-to-center spacing is 3x the required embedment — i.e., standard installation is based on a minimum 5″ end distance.
[7] Structural composite lumber beams have sides that show either the wide face or the lumber strands/veneers. Values in the tables reflect installation into the wide face.
[8] Concrete shall have a minimum compressive strength of f'_c = 3,000 psi.
[9] Grout-filled CMU (GFCMU) shall have a minimum compressive strength of f'_m = 1,500 psi.
[10] PA models installed vertically in the top of a grouted masonry wall with 6″ embedment and (12) 0.148″ x 3″ nails achieve an allowable uplift load of 1,890 lb.
[11] For PA models, 0.148″ x 1½″ nails may be substituted for 0.148″ x 3″ nails at 100% of listed load and with a 15% increase in deflection. For installation over sheathing, use 3″-long nails minimum.
[12] For PAI/MPAI models, 0.148″ x 1½″ nails shall be used directly onto framing member. For installation over sheathing, use 2⅛″-long nails minimum.
[13] **Fasteners:** Nail dimensions are listed diameter by length.
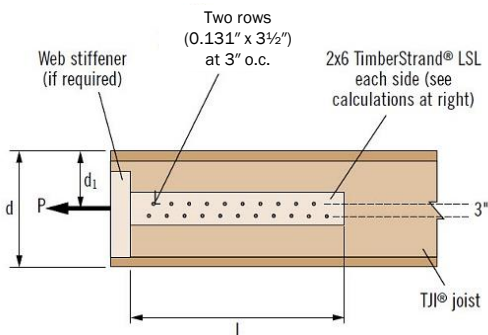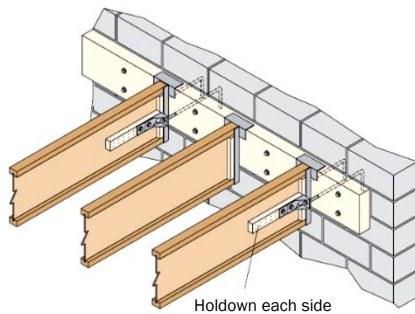
*Table and footnotes adopted from Simpson Strong-Tie® *Wood Construction Connectors 2021-2023* (C-C-2021), page 63. Reference manufacturer's catalog for installation information.

PA/PAI/MPAI Purlin to Concrete-Block Wall

PA/HPA Purlin to Concrete Wall
PAI/MPAI for I-joist applications

#4 rebar min.

Pressure-treated barrier may be required

4" for PA
6" for HPA28
8¼" for HPA35

Min. solid 3x (nominal) or double 2x

Hanger not shown for clarity
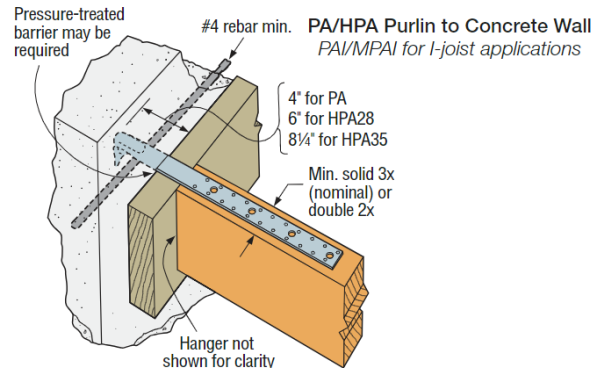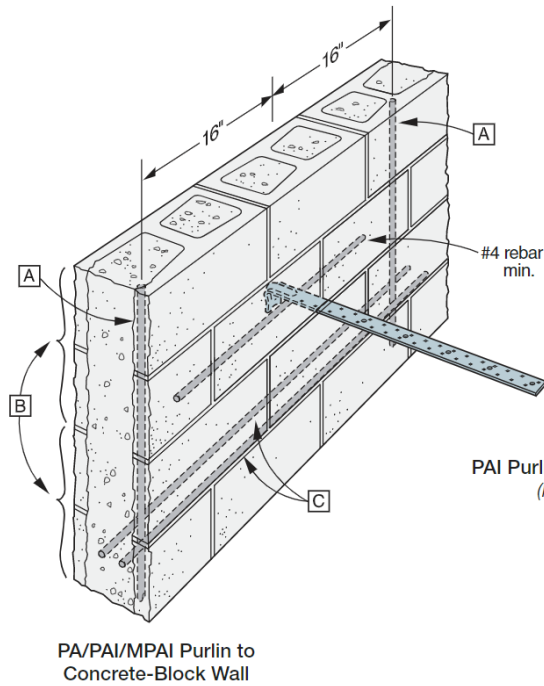
PAI Purlin to Concrete Wall
(MPAI similar)

Preservative-treated barrier may be required

#4 rebar

2⁵⁄₁₆" min.

Hanger not shown for clarity

Alternative Option – Connection Tie to Web of TJI® Joist

Holdown each side

Web stiffener (if required)

Two rows (0.131″ x 3½″) at 3″ o.c.

2x6 TimberStrand® LSL each side (see calculations at right)

TJI® joist

To calculate the length of the TimberStrand® LSL block (to transfer shear to joist flange):

1. Find:
$$L_1 = \frac{0.75(PK)d_1}{C_D V_A - [V_{DL} + (0.75 V_{LL})]}$$

2. Find:
$$L_2 = \frac{3}{2}n + 3 \text{ where } n = \frac{PK}{V_n C_D}$$

3. Length of TimberStrand® LSL Block: $L = Max(L_1, L_2)$

Where:

L_1, L_2 = Length of block [in.]

P = Axial load [lb]

K = 0.6 for wind; 0.7 for seismic. (Values account for ASD load combinations).

n = Number of nails

d_1 = Distance to axial load from top of joist [in.]

C_D = Load duration factor

V_A = Allowable shear load for TJI® joist [lb]

V_{DL} = Shear load due to gravity dead load [lb]

V_{LL} = Shear load due to gravity live load [lb]

V_n = (0.131″ x 3½″) nail shear capacity (see table below)

TJI® Web Thickness	V_n (100%) (lb)
3/8″	104
7/16″	121