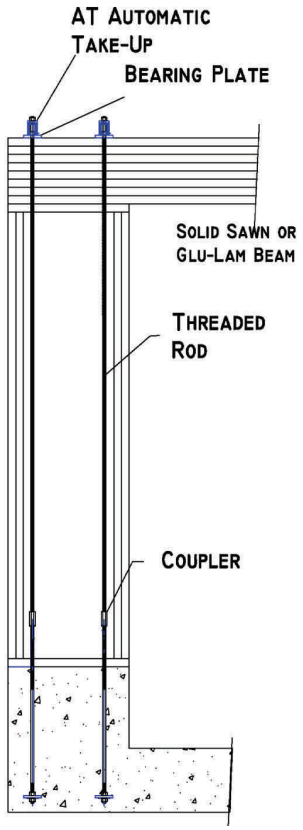
Technical Note 12: Portal Frame Tie-Downs

Lowest Deflection

Shrinkage Compensated

Faster Installation



Garage returns are usually the weakest walls in a building. Narrow walls coupled with standard holdowns and/or straps allow excessive drift and reduce performance.

AutoTight® resolves these problems by providing a system that is stronger, has lower elongation and self adjusts for shrinkage and settling.

Lowest Drift Systems

The table elongation includes the rod elongation (8'), bearing plate and shrinkage compensator elongations.

The system accommodates wood shrinkage (Up to 1" or more), any wood species, and any width wall. It can be used with wood or steel shear walls.

Specify the system, PF 4 (1/2") through PF 9 (1-1/8"). A 10' threaded rod, bearing plate, shrinkage compensator, nut, washer and coupler are provided for your embedment.

Need lower Drift? Upsize the system or use shorter rod to provide even lower drift. See engineering, page 4.

Portal Frame

System #	Components				Allowable Loads	System Elongation @ Alowable	Embedment
	Rod Diameter	Bearing Plate	Take-Up Device	Coupler			Diameter
PF4	1/2	S5	AT6A	CNR45	4,420	0.137	5/8
PF5	5/8	S7		CN5	6,900	0.143	5/8
PF6	3/4	S10		CNR67	9,940	0.147	7/8
PF7	7/8	S14	AT100	CN7	13,530	0.156	7/8
PF8	1	L17		CN8	17,282	0.156	1
PF9	1 1/8	L25	AT125	CN9	22,370	0.158	1 1/8

Rod is ASTM A307. Diameter as shown X 10'.
Bearing plates are sized for Douglas Fir-Larch. See catalog for other sizes and capacities.
Take-Up Devices (Shrinkage Compensators) are per ICC ESR 1344
Allowable loads are typically limited by rod strength.
Elongation is the sum of the Rod (8'), Bearing Plate and Shrinkage Compensator movements.
Increase system size to limit wall drift. See engineering page 4.

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Technical Note 12: Portal Frame Tie-Downs

AutoTight - A Tighter Connection

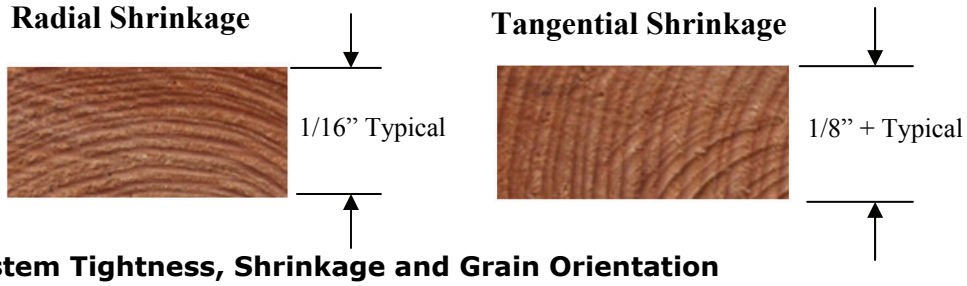
Tight at the Top

Solid Sawn Headers may shrink and settle a half inch or more. Using a glulam reduces shrinkage. But 1/4" shrinkage is still possible. Straps connecting the members will buckle, destroying the connection strength.

The solution is the AutoTight Portal-Frame Connection. Working at the top AutoTight provides the tightest possible connection.

Tight at the Bottom

A pressure treated mudsill is often used. Normal practice is to deliver mudsill material wet. This can lead to an <u>average</u> looseness of just under 1/8". However, since there is a single mudsill perhaps half the connection will experience radial shrinkage and half will experience tangential. And you are unlikely to have any idea what the actual shrinkage will be. So

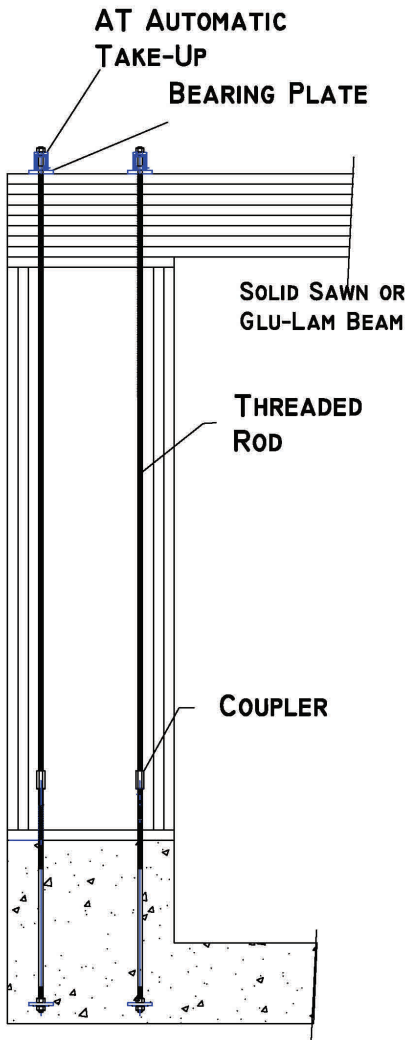


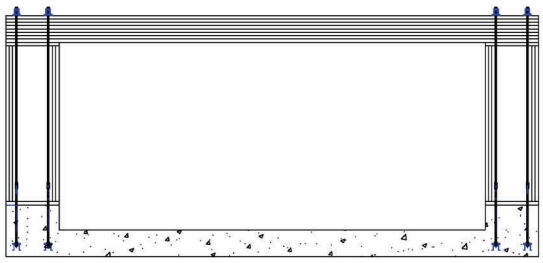
System Tightness, Shrinkage and Grain Orientation

"Wood is an anisotropic material with respect to shrinkage characteristics. It shrinks most in the direction of annual growth rings (tangential) about one-half as much across the rings (radial)."

Looseness directly affects the performance of tie-down systems. It is assumed that we should look at "average shrinkage". Average shrinkage may be appropriate with stacked multiple wood members. But two locations, the mudsill and a double top plate, may have worst case shrinkage that adversely affects performance. Shrinkage at these locations may exceed 1/8" to 3/16". Two alternate courses of action are prudent. Use the worst case shrinkage **or** use a shrinkage compensator.

Technical Note 12: Portal Frame Tie-Downs





Installation:

Install coupler. Use straight or reducing coupler as needed.

Drill oversize hole in Glulam or solid sawn header. Recommended oversize is 1/4" to 1/2". Locate tie-downs as close to the ends of the wall. To avoid joists, rod hole (in header) may be up to 2" out of plumb.

Cut threaded rod to length and install in wall. Provide 8" of rod through the header.

Install bearing plate, AT Shrinkage compensator , washer and nut.

Tighten: Finger Tight plus 1/2” turn.

Activate: Pull and discard activation screw.

Portal	Rod (A307)		Embedment	Coupler		Bearing Plate		AT Take-Up		Nut
Frame	Model #	Size	(by others)	Model #	Size	Model #	Size	Model #	Size	
PF4	R4	1/2"Ø	5/8"Ø	CNR45	1/2" X 5/8"	S5	1/4" X3" X 3"	AT6A-1.5	3/4"Ø	1/2"-13
PF5	R5	5/8"Ø	5/8"Ø	CN5	5/8" X 5/8"	S7	3/8" X 3-1/2" X 3-1/2"			5/8"-11
PF6	R6	3/4"Ø	7/8"Ø	CNR67	3/4" X 7/8"	S10	1/2" X 3-1/4" X 5"			3/4"-10
PF7	R7	7/8"Ø	7/8"Ø	CN7	7/8" X 7/8"	S14	3/4" X 3-1/4" X 7"	AT100	1"Ø	7/8"-9
PF8	R8	1"Ø	1"Ø	CN8	1" X 1"	L17	1/2" 5" X 5"			1"-8
PF9	R9	1-1/8"Ø	1-1/8"Ø	CN9	1-1/8" X 1-1/8"	L25	3/4" X 5-1/2 X7-1/2"	AT125	1-1/4"Ø	1-1/8"-7

Rod is supplied as a 10' section. Cut as needed. All rod is A307
Threaded hardware is Unified National Coarse (UNC), Grade 2 or equivalent. Washers are SAE
Plates are sized for Douglas Fir-Larch with a compression capacity of 625 psi. Change bearing plate as needed for other Species
AT Take-Up (Shrinkage Compensator) accomodates a minimum of 1.100" Shrinkage or settling
Embedment is supplied by others. Change coupler to match embedment.

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Technical Note 12: Portal Frame Tie-Downs

Tie-Down Engineering Example

Step 1. List System Limits.

Portal Frame Tie-Down Requirements		
Tension Capacity	11,000	pounds
Elongation Limit	0.100	Inches
Rod Tension Length	7'	84"
Wood	DF-L	
Shrinkage	1/2"	

Step 2. List Tie-Down Components and capacities:

Trial #1	Size	Description	Capacity (From Catalog)	Elongation @	
				Capacity @ 10'	Adjusted
Rod	7/8" A307	7/8" -9 NC X 84"	13,530	0.121	0.069
Bearing Plate	L20	5/8" X 5-1/2" X 6"	21,016	0.040	0.021
Shrinkage Compensator	AT100	Fits 7/8"-1"	25,300	0.032	0.014
		delta r	NA	0.002	0.002
Shrinkage		1/2"	NA	0.000	0.000
Capacity		11,000 pounds	Elongation		0.106

List each component. Include allowable design capacity and elongation or deformation. Adjust the elongation for each item based on demand/capacity ratio from full load elongation
Note: the shrinkage compensator includes a demand/capacity adjustment plus an item called Delta R. Delta r is always added in full.
List shrinkage. Adjust to 0.000 if Take-Up is used. Add in shrinkage if no Take-Up

Step 3. Adjust components to reduce elongation.

Trial #2	Size	Description	Capacity (From Catalog)	Elongation @	
				Capacity @ 10'	Adjusted
Rod	1" A307	1" -8 NC X 84"	17,670	0.121	0.053
Bearing Plate	L20	5/8" X 5-1/2" X 6"	21,016	0.040	0.021
Shrinkage Compensator	AT100	Fits 7/8"-1"	25,300	0.032	0.014
		delta r	NA	0.002	0.002
Shrinkage		1/2"	NA	0.000	0.000
Capacity		11,000 pounds	Elongation		0.090

Changing the rod from a 7/8” to a 1” rod reduces the elongation to 0.090”.

System Acceptable. meets all specifications!

AutoTight® - Connection Perfection ™

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