



### Tiedown System Elongation (Code References Step-by-Step)

Total System Elongation is determined between reaction points. Typical elongation items include rod, bearing plates and shrinkage compensators (TUDs). Component elongation is determined per the following:

#### Rod Elongation

Rod stretch is calculated per AC391 S3.2.1.1 which states:

$$\Delta \text{Rod (Rod Elongation)} = PL/AnE \quad (\text{Eq. 1})$$

$$An \text{ (Area net)} = 0.7854 (D-0.9743/n)^2 \quad (\text{Eq. 2})$$

where: P = Load, L = length (between reaction points),  
D = rod dia, n = threads per inch, E = elastic modulus = 29,000,000.

Example 1: A 120" length of R7A307 (7/8"-9 NC, A307) at 11,000 lbs. has an elongation of 0.099" (Rolled Thread)

#### Bearing Plate Deflection

Bearing Plates transfer compression loads into the structure through wood bearing.

Bearing Plate deflection is calculated per ICC ES AC391 Sect 1.4.6 and Sect 3.2.1.2, July 1, 2010, per AISC 360 and the wood-bearing requirements of the 2005 NDS.

ICC ES AC 391 section 3.2.1.2 and 2005 NDS state that the maximum allowable deformation is 0.040 inch.

AutoTight rates Bearing Plates at the load that produces a 0.040 inch deformation.

ICC ES AC 391 section 3.2.1.2 states the wood bearing deformation is linear, based on 0.040 inch at full load.

Bearing Plate Deflection = 0.040" \* Applied Load / Rated Load

Example: Assume a required reaction of 11,000 pounds on Douglas Fir.  
Selecting an S12 bearing plate (capacity 12,360 pounds) provides the required capacity.

Deformation is 0.040" \* 11,000 / 12,360 = 0.036"

#### TakeUp Device Elongation

Shrinkage compensators require two separate deflection evaluations that are added to system deflection: These are load-deflection and Delta r ( $\Delta r$ ). Determined per AC316 sec. 6.5 and 6.6.1 and AC391 sec. 3.1.1

**Deflection under load** is determined by the ratio of the design load to the rated load times the deflection at the rated load.

**Delta r ( $\Delta r$ )** is independent of load and is added in full to the system deflection.

Example:

Reaction Load = 11,000 pounds

Shrinkage Compensator AT 100, Capacities per ICC ESR 1344.

Rated Capacity: 25,300 pounds.

Deflection at Maximum Load: 0.032"

Delta r ( $\Delta r$ ) = 0.002"

Maximum Expansion Travel 1.1"

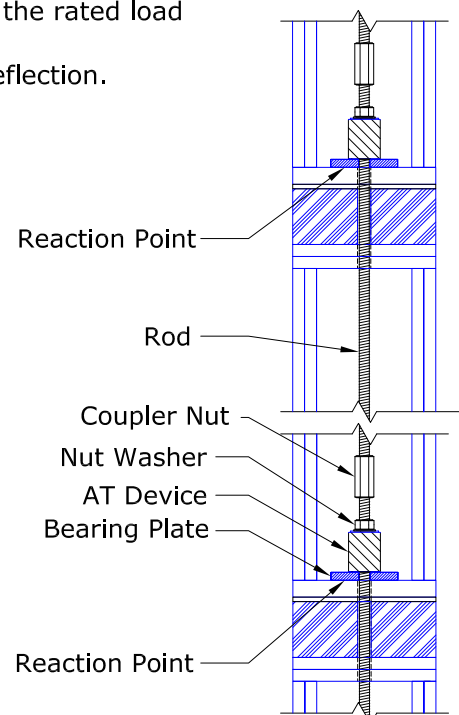
Deflection at applied load = 0.032 \* 11,000/25,300 = 0.014"

Delta r ( $\Delta r$ ) = 0.002"

**TakeUp Total Deformation = 0.016"**

#### Total System Elongation

per above:	Rod Elongation	0.099"
	Bearing Plate Compression	0.036"
	Shrinkage Compensator Compression	0.016"
	<b>System Elongation Total</b>	<b>0.151"</b>



This sample illustrates the first stacked bar on [page 7](#). Other samples similar.