Rod Elongation

Rod elongation is a critical performance criteria.

Rod stretch is calculated per AC391 3.2.1.1 which states:

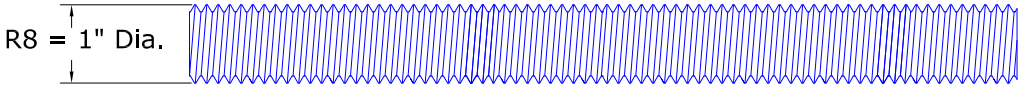
ΔRod = PL/AnE (Eq. 1)

An (Area net) = 0.7854 (D-0.9743/n)^2 (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 R8A307 (1" dia., A307) at 17,671 lbs. stretches (elongates) 0.121"
Note: the area of continuous threaded (or reduced diameter) rod is significantly less than full diameter (FD) rod.

Example 2: A 120" length of R8C1045 (1" dia., ASTM A108-C1045) at 32,700 lbs. stretches 0.200" Rod Strength limit is 35,340 pounds)



Reducing Rod Stretch can be done by: 1. upsizing the rod diameter (Best), or 2. changing to a full diameter rod, or 3. by inserting "stretch rod" into the system.

Increasing rod diameter is the most common method of reducing elongation. **Example:** if we upsize the rod from 1" to 1-⅛" rod, elongation drops from 0.121 to 0.096". Increasing rod diameter by one size reduces elongation by 0.025".

Full Diameter Rod

Rod stretch for full diameter rod may use An = π * (Ø^2/4). If full diameter rod is used equation 2 results are changed to:

A 120" length of R8A307 at 17,671 lbs load stretches 0.093" or an elongation reduction of 0.027

Stretch Rod is larger rod inserted into the system to reduce stretch. Sometimes 1-¾" rod is inserted into the tensile system to reduce system stretch. We do this often with tall floor heights. Consult Factory.

Automatic Calculations

Rod elongation is one of many calculations used in system design. This work can be tedious and subject to error. To assist you we offer the AutoTight Auto Design package. This package designs the system floor-by-floor and calculates either rod or system elongation in seconds. The program allows you to change rod or bearing plates to reduce elongation. Download the software and instructions for a fast-accurate experience. For some changes, such as adding full diameter rod and "stretch" rod, please call factory.

AutoTight Rod

AutoTight rod supplied with a continuous thread. Field cut as needed. Rod may be ordered precut with sufficient lead time. Standard lengths are 3', 6', 10', and 12' foot.

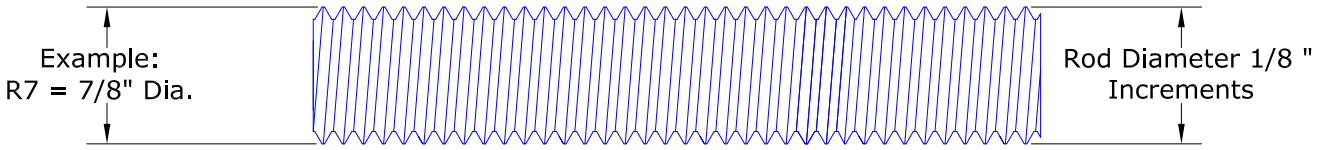
Material Designation is R followed by diameter in 1/8's of an inch followed by the Alloy name

Example:
R5A307 is 5/8"-11 NC threaded rod made from ASTM A307 Steel (Standard Strength)
R6C1045 is 3/4"-10 NC threaded rod made from ASTM A108-C1045 Steel (High Strength)
R9B7 is 1-1/8"-7 NC threaded rod made from ASTM A193-B7 Steel (Higher Strength)

Standard Finish: Black. HDG finish is available at extra cost. **HDG rod must be chased to fit standard nuts & couplers.**

Diameter and Thread: Rod is available from 1/2" (R4) to 1-3/4" (R14) diameter. Thread is Unified National Coarse (NC or UNC). Other sizes, material and lengths are available as needed.

Code Acceptance: Values shown comply with IBC 2009, IBC 2006, CBC 2007, COLA 2008, COLA 2011, OSSC 2007
Limit States Design values also available. Call Factory



Allowable Tensile Capacity 2009 International Building Code (IBC 2009)		
Model Number	Diameter Thread	AISC 13th Ed. 100%
ASTM A307		
R4A307	1/2"-13 NC	4,420
R5A307	5/8"-11 NC	6,900
R6A307	3/4"-10 NC	9,940
R7A307	7/8"-9 NC	13,530
R8A307	1" - 8 NC	17,670
R9A307	1-1/8" -7 NC	22,370
R10A307	1-1/4" -7 NC	27,610
R12A307	1-1/2" - 6 NC	39,760
R14A307	1-3/4"-5 NC	54,120

Allowable Tensile Capacity 2009 International Building Code (IBC 2009)		
Model Number	Diameter Thread	AISC 13th Ed. 100%
ASTM C1045		
R4C1045	1/2"-13 NC	8,840
R5C1045	5/8"-11 NC	13,810
R6C1045	3/4"-10 NC	19,880
R7C1045	7/8"-9 NC	27,060
R8C1045	1" - 8 NC	35,340
R9C1045	1-1/8" -7 NC	44,730
R10C1045	1-1/4" -7 NC	55,220
R12C1045	1-1/2" - 6 NC	79,520
R14C1045	1-3/4"-5 NC	108,240

ASTM A193-B7		
R4B7	1/2"-13 NC	9,200
R5B7	5/8"-11 NC	14,380
R6B7	3/4"-10 NC	20,710
R7B7	7/8"-9 NC	28,190
R8B7	1" - 8 NC	36,820
R9B7	1-1/8" -7 NC	46,590
R10B7	1-1/4" -7 NC	57,520
R12B7	1-1/2" - 6 NC	82,830
R14B7	1-3/4"-5 NC	112,750

ASTM A354-BD		
R9A354	1-1/8" -7 NC	55,915
R10A354	1-1/4" -7 NC	69,030

1. Material Properties:
   ASTM A307 Fu = 60, Fy = 43 ksi. ASTM A36 Fu = 58, Fy = 36 ksi.
   ASTM F1554 Gr. 36 Fu = 58, Fy = 36 ksi. ASTM A108-C1045 Fu = 120, Fy = 92
   ASTM A449, (< 1" Ø):Fu=120 Fy=92 ksi., (1 1/8" - 1 1/2" Ø):Fu=105, Fy=81 ksi.
   (1 3/4"Ø):Fu=90, Fy=58 ksi.
   ASTM A325, (<1" Ø):Fu=120 Fy=92 ksi. (1 1/8" - 1 1/2" Ø):Fu=105, Fy=81 ksi.
   (1 3/4" Ø):Fu=90, Fy=58 ksi.
   ASTM A193-B7, Fu=125, Fy=105 ksi. ASTM F1554 Gr. 105, Fu=125, F =105 ksi.
   ASTM A354-BD, Fu = 150, Fy = 130 ksi.
2. Stress increase not allowed with AISC 13th Ed capacities. (IBC 06 & later)
3. Rod stretch must be calculated per AC391 3.2.1.1 which says
   ΔRod = PL/AnE where: P=Load, L=length, An=0.7854 (D-0.9743/n)^2,
   D = rod dia, n = threads per inch, E = elastic modulus = 29e6.
   Example: A 120" length of R8A307 at 17,671 lbs load stretches 0.121"
   Exception: Rod stretch for full diameter rod may use A = π*(Ø^2/4).
Depending on the jurisdiction the stretch limit may be 1/8", 0.200", other or not specified.
5. Larger Ø rod (1-1/2" to 1-3/4" Ø) used for stretch reduction. See factory.
6. Limit states design loads are also available.