FLORIDA DEPARTMENT OF TRANSPORTATION
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Florida Method of Test for PERFORMING ROTATIONAL CAPACITY TEST - LONG BOLTS IN TENSION CALIBRATOR

Designation FM 5-581

(Reference: FHWA Report No. FHWA-SA-91-031, dated May 1991, Appendix A1 Procedure for Performing Rotational Capacity Test, Long Bolts in Tension Calibrator)

1. SCOPE

1.1 This method covers the procedure for performing Rotational Capacity tests on bolts using a Tension Calibrator to ensure that fastener assemblies are capable of developing the specified bolt tension.

2. EQUIPMENT REQUIRED

2.1 Calibrated bolt tension measuring device of the size required for the bolts to be tested. Mark off a vertical line and lines at 1/3 of a turn, (120 degrees); and 2/3 of a turn, (240 degrees) from vertical in a clockwise direction on the faceplate of the calibrator.

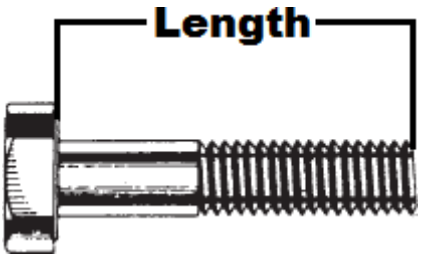
2.2 Calibrated torque wrench (Use a dial indicator type if the procedure utilizes a spud wrench.). Use a calibrated torque wrench that has been calibrated within the last 12 months.

2.3 Spacers and/or washers with a hole size no larger than 1/16 inch greater than the bolt to be tested.

2.4 Rigid steel section to mount calibrator. Flange of girder or cross-frame accessible from the ground is satisfactory.

3. PROCEDURE

3.1 Install the nut on the bolt and measure stick out of bolt threads when 3 to 5 full threads of the bolt are located between the bearing face of the nut and the end of the shank. Measure the bolt length, the distance from the end of the shank to the underside of the bolt head.



3.2 Install the bolt into the tension calibrator and install the required number of shim plates and/or washers to produce the thread stick out measured in Step 3.1. At least one washer must always be provided under the turned element.

3.3 Tighten bolt using a hand wrench to the snug tensions listed below to a tolerance of -0 kips, +2 kips.

Bolt Dia. (in.)	1/2	5/8	3/4	7/8	1	1 1/8	1 1/4	1 3/8	1 1/2
Snug Tension (kips)	1	2	3	4	5	6	7	9	10

3.4 Match mark the nut to the vertical stripe on the face plate of the bolt calibrator.

3.5 Using the calibrated manual torque wrench, tighten the bolt to the tension listed below and record the torque when the bolt reaches the required tension. The torque must be measured with the nut in motion.

Bolt Dia. (in.)	1/2	5/8	3/4	7/8	1	1 1/8	1 1/4	1 3/8	1 1/2
ASTM A 325 Bolt – Tension (kips)	12	19	28	39	51	56	71	85	103

3.6 Further tighten the bolt to the rotation listed below. The rotation is measured from the initial marking in Step 3.4. Record the bolt tension and torque when the nut reaches the required rotation. The torque must be measured with the wrench in motion. Assemblies that fail prior to this rotation, either by stripping or fracture, fail the test.

Bolt Length (Measured in Step 3.1)	4 x bolt dia. or less	Greater than 4 x but no more than 8 x bolt dia.	Greater than 8 x bolt dia.
Required	2/3	1	1 1/6

Rotation			

3.7 The bolt tension measured in Step 3.6 after the required rotation must equal or exceed the values shown below. Assemblies that do not meet this tension have failed the test.

Bolt Dia. (in.)	1/2	5/8	3/4	7/8	1	1 1/8	1 1/4	1 3/8	1 1/2
ASTM A 325 Bolt – Tension (kips)	14	22	32	45	59	64	82	98	118

3.8 Calculate the maximum allowable torque at the required fastener tension in Step 3.5 by using the following equation:

$$\text{Torque} = 0.25 \times P \times D$$

Where:

Torque = Measured Torque in foot-pounds
P = Measured Bolt Tension in pounds
D = Nominal Diameter in feet

The test is considered to be failed test if the measured torque exceeds the calculated torque in accordance with the above equation. If an assembly fails due to excessive torque, the test may be repeated on another assembly from the same LOT. If additional lubricant is applied to the subsequent test assembly (and an acceptable torque value is achieved), the assembly has passed this portion of the test and the same additional lubricant must be applied to all production bolts from this LOT.

3.9 Loosen and remove the nut, and examine the threads on the nut and bolt. No signs of shear failure, stripping, or torsional failure of the bolt should be evident. Assemblies that have evidence of shear, stripping, or torsional failure have failed the test.

3.10 Advance the nut by hand onto the bolt to the position on the bolt where the test was performed. If the nut cannot be advanced by hand onto the bolt, the assembly has failed the test.

3.11 Visibly inspect the appearance of the assembly. Assemblies with visible manufacturing defects such as incomplete threading, geometric distortions, cracks, or surface fissures have failed the test.