

**APPENDIX A1 – A325
REVISED FEBRUARY 2005**

PROCEDURE FOR PERFORMING ROTATIONAL CAPACITY TEST LONG BOLTS IN TENSION CALIBRATOR

EQUIPMENT REQUIRED:

1. Calibrated bolt tension measuring device of the size required for the bolts to be tested.
2. Calibrated torque wrench and spud wrenches.
3. Spacers with holes 1/16 larger than bolt to be tested or nominal diameter washers.
4. Steel section to mount the tension calibrator.

PROCEDURE:

A ROTATIONAL CAPACITY TEST CONSISTS OF 2 ASSEMBLIES.

1. Measure the bolt length, the distance from the end of the bolt to the washer face at the bolt head to shank interface.
2. Install the bolt in the tension calibrator with the required spacers or washers so that the bolt stick-out is flush with the nut to a maximum of three threads. This will typically provide three to five threads within the grip, the distance between the bolt head and the inside face of the nut. This same stick-out requirement applies during installation.
3. Tighten the fastener assembly using a spud wrench to the tensions listed below -0 / +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
Initial Tension (kips)	1	2	3	4	5	6	7	9	10

4. Match mark the bolt, nut and face plate of the calibrator.
5. Using the calibrated torque wrench, tighten the fastener assembly to at least the minimum installation tension listed below and record both the tension and torque. Torque shall be read with the nut rotating. The torque value from the test shall not exceed $T = .25 PD$. P = tension in pounds. D = Dia. (in.)/12 = bolt diameter in feet.

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

6. Further tighten the bolt to the rotation listed below. The rotation is measured from the initial marking in step 4.

Bolt Length (from step 1)	4X bolt dia. Or less	Greater than 4 dia. But no more than 8 dia.	Greater than 8 bolt dia.
Required Rotation	2/3	1	1 1/6

7. Record the tension at the completion of the rotation in Step 6. The tension shall equal or exceed 1.15 x the minimum installation tension. The minimum required values are listed in the table below.

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

8. Loosen and remove the nut. There shall be no signs of thread shear failure, stripping or torsional failure. The nut shall turn, with your fingers, on the bolt threads to the position it was in during the test. The nut does not need to run the full length of the threads. If you cannot turn the nut with your fingers it is considered thread failure.

FAILURE:

The following constitute a failure of the rotational capacity test.

1. Exceeding the maximum allowable torque in the torque/tension comparison.
2. Failure to achieve the required rotation.
3. Failure to achieve the required tension at the required rotation.
4. Thread failure.

Failure of any one of these items on either assembly constitutes a failure of the rotational capacity test. When a failure occurs, the subject lot of fasteners is rejected. The contractor is given the option to clean and re-lubricate as necessary and then retest the fastener assemblies.

**APPENDIX A1 – A325
REVISED FEBRUARY 2005**

**PROCEDURE FOR PERFORMING ROTATIONAL CAPACITY TEST
BOLTS TOO SHORT TO FIT TENSION CALIBRATOR**

ONLY THOSE BOLTS TOO SHORT TO FIT IN THE TENSION MEASURING DEVICE SHALL BE TESTED USING THIS PROCEDURE. TYPICALLY THESE BOLTS ARE LESS THAN 4 DIAMETERS LONG.

EQUIPMENT REQUIRED:

1. Calibrated torque wrench and spud wrenches.
2. Spacers with holes 1/16 larger than bolt to be tested or nominal diameter washers.
3. Steel section with holes 1/16 larger than the bolt diameter. Splice holes in the steel on the project can be used.

PROCEDURE:

A ROTATIONAL CAPACITY TEST CONSISTS OF 2 ASSEMBLIES.

1. Measure the bolt length, the distance from the end of the bolt to the washer face at the bolt head to shank interface.
2. Install the bolt in the steel plate with the required spacers or washers so that the bolt-stick out is flush with the nut to a maximum of three threads. This will typically provide three to five threads within the grip, the distance between the bolt head and the inside face of the nut. This same stick-out requirement applies during installation.
3. Provide an initial tension in the fastener assembly using a spud wrench. The torque should not exceed 20% of the maximum torque allowed in step #5.
4. Match mark the nut, bolt and plate.
5. Tension the bolt using a torque wrench to rotate the nut as required in the table below. Prevent the bolt head from rotation. Read the torque at the required rotation with the nut in motion.

Bolt Length (measured in Step #1)	4 x bolt dia. Or less	Greater than 4 x but no less than 8 x bolt dia.
Required Rotation	1/3	1/2

The measured torque should not exceed the values listed below. Assemblies that exceed the listed torques have failed the test. These torque values are based on an assumed tension of 1.15 x minimum installation tension.

Bolt Dia. (in.)	1/2	5/8	3/4	7/8	1	1 1/8	1 1/4	1 3/8	1 1/2
Torque (ft-lbs)	150	290	500	820	1230	1500	2140	2810	3690

6. Further tighten the bolt to the rotation listed below. The rotation is measured from the initial marking in step 4. Assemblies that fail prior to this rotation either by stripping or fracture fail the test.

Bolt Length (from step 1)	4 x bolt dia. or less	Greater than 4 x but no less than 8 x bolt dia.
Required Rotation	2/3	1

7. Loosen and remove the nut. There shall be no signs of thread shear failure, stripping or torsional failure. The nut shall turn, with your fingers, on the bolt to the position it was in during the test. The nut does not need to run the full length of the threads. If you cannot turn the nut with your fingers it is considered thread failure.

FAILURE:

The following constitute a failure of the rotational capacity test.

1. Exceeding the maximum allowable torque.
2. Failure to achieve the required rotation.
3. Thread failure.

Failure of any one of these items on either assembly constitutes a failure of the rotational capacity test. When a failure occurs, the subject lot of fasteners is rejected. The contractor is given the option to clean and re-lubricate as necessary and then retest the fastener assemblies.

**APPENDIX A1 - A490
REVISED FEBRUARY 2005**

**PROCEDURE FOR PERFORMING ROTATIONAL CAPACITY TEST
LONG BOLTS IN TENSION CALIBRATOR**

EQUIPMENT REQUIRED:

1. Calibrated bolt tension measuring device of the size required for the bolts to be tested.
2. Calibrated torque wrench and spud wrenches.
3. Spacers with hole 1/16 larger than bolt to be tested or nominal diameter washers.
4. Steel section to mount the tension calibrator.

PROCEDURE:

A ROTATIONAL CAPACITY TEST CONSISTS OF 2 ASSEMBLIES.

1. Measure the bolt length, the distance from the end of the bolt to the washer face at the bolt head to shank interface.
2. Install the bolt in the tension calibrator with the required spacers or washers so that the bolt stick-out is flush with the nut to a maximum of three threads. This will typically provide three to five threads within the grip, the distance between the bolt head and the inside face of the nut. This same stick-out requirement applies during installation.
3. Tighten the fastener assembly using a spud wrench to the tensions listed below -0 / +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
Initial Tension (kips)	2	2	4	5	6	8	10	12	15

4. Match mark the bolt, nut and face plate of the calibrator.
5. Using the calibrated torque wrench, tighten the fastener assembly to at least the minimum installation tension listed below and record both the tension and torque. Torque shall be read with the nut rotating. The torque value from the test shall not exceed $T = .25 PD$. P= tension in pounds. D= Dia. (in.)/12 = bolt diameter in feet.

Bolt Dia. (in.)	1/2	5/8	3/4	7/8	1	1 1/8	1 1/4	1 3/8	1 1/2
Tension (kips)	15	24	35	49	64	80	102	121	148

6. Further tighten the bolt to the rotation listed below. The rotation is measured from the initial marking in step 4.

Bolt Length (from step 1)	4X bolt dia. Or less	Greater than 4 dia. But no more than 8 dia.	Greater than 8 bolt dia.
Required Rotation	2/3	1	1 1/6

7. Record the tension at the completion of the rotation in Step 6. The tension shall equal or exceed 1.15 x the minimum installation tension. The minimum required values are listed in the table below.

Bolt Dia (in.)	1/2	5/8	3/4	7/8	1	1 1/8	1 1/4	1 3/8	1 1/2
Tension (kips)	17	28	40	56	74	92	117	139	170

8. Loosen and remove the nut. There shall be no signs of thread shear failure, stripping or torsional failure. The nut shall turn, with your fingers, on the bolt threads to the position it was in during the test. The nut does not need to run the full length of the threads. If you cannot turn the nut with your fingers it is considered thread failure.

FAILURE:

The following constitute a failure of the rotational capacity test.

1. Exceeding the maximum allowable torque in the torque/tension comparison.
2. Failure to achieve the required rotation.
3. Failure to achieve the required tension at the required rotation.
4. Thread failure.

Failure of any one of these items on either assembly constitutes a failure of the rotational capacity test. When a failure occurs, the subject lot of fasteners is rejected. The contractor is given the option to clean and re-lubricate as necessary and then retest the fastener assemblies.

**APPENDIX A1 - A490
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PROCEDURE FOR PERFORMING ROTATIONAL CAPACITY TEST BOLTS TOO SHORT TO FIT TENSION CALIBRATOR

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4. Match mark the nut, bolt and plate.
5. Tension the bolt using a torque wrench to rotate the nut as required in the table below. Prevent the bolt head from rotation. Read the torque at the required rotation with the nut in motion.

Bolt Length (measured in Step #1)	4 x bolt dia. Or less	Greater than 4 x but no less than 8 x bolt dia.
Required Rotation	1/3	1/2

The measured torque should not exceed the values listed below. Assemblies that exceed the listed torques have failed the test. These torque values are based on an assumed tension of 1.15 x minimum installation tension.

Bolt Dia. (in.)	1/2	5/8	3/4	7/8	1	1 1/8	1 1/4	1 3/8	1 1/2
Torque (ft-lbs)	180	370	630	1020	1540	2160	3050	3980	5310

6. Further tighten the bolt to the rotation listed below. The rotation is measured from the initial marking in step 4. Assemblies that fail prior to this rotation either by stripping or fracture fail the test.

Bolt Length (from step 1)	4 x bolt dia. or less	Greater than 4 x but no less than 8 x bolt dia.
Required Rotation	2/3	1

7. Loosen and remove the nut. There shall be no signs of thread shear failure, stripping or torsional failure. The nut shall turn, with your fingers, on the bolt to the position it was in during the test. The nut does not need to run the full length of the threads. If you cannot turn the nut with your fingers it is considered thread failure.

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