

## **ROTATIONAL CAPACITY TEST FOR LONG BOLTS IN TENSION CALIBRATOR**

### **ROTATIONAL CAPACITY (RC)**

The Rotational Capacity (RC) Test for all high strength fasteners shall be performed in the **shop and in the field** as required by Article 4153.06 of the Standard Specifications.

There are two separate rotation capacity requirements:

1. Fasteners (bolts, nuts and washers) received at the project site shall have been RC tested by the supplier or manufacturer prior to shipment. Each combination of production lots must have a special RC lot number. This number must be readily identifiable on each container of fasteners.
2. Prior to installation, the contractor shall be required to test all RC lots as supplied. **NOTE:** Tests are not intended to match the values provided by the suppliers.

### **EQUIPMENT REQUIRED**

1. Calibrated bolt tension measuring device of size required for bolts to be tested
2. Calibrated torque wrench
3. Shims shall have a minimum cross-sectional area of 5 times the cross-sectional area of the bolt being tested. The hole in the shim adjacent to the washers shall not be larger than 1/16" (2mm) than the bolt diameter being tested.
4. Steel section to mount tension-measuring device (Flange of girder or cross frame accessible from the ground is satisfactory.)

### **PROCEDURE**

1. Install the bolt into the tension calibrator. Install the required number of shim plates and/or washers. One washer under the nut must always be used to cover a minimum of three full threads. A combined total of no more than five shims and washers may be used. (Need a minimum of 2-3 threads behind nut, when properly installed.)
2. Tighten the nut using a hand wrench to the initial tensions listed on the following page.  
Tolerance: **-0 kips, + 2 kips (-0 kN, + 9 kN)**

Table A1

|                        |     |     |     |     |   |       |       |       |       |
|------------------------|-----|-----|-----|-----|---|-------|-------|-------|-------|
| Bolt Diameter (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    |

Table A1M

|                      |    |    |    |    |    |    |    |    |    |
|----------------------|----|----|----|----|----|----|----|----|----|
| Bolt Diameter (mm)   | 13 | 16 | 19 | 22 | 25 | 29 | 32 | 35 | 38 |
| Initial Tension (kN) | 4  | 9  | 13 | 18 | 22 | 27 | 31 | 40 | 44 |

- Match mark the bolt tip, nut, and the faceplate of the bolt calibrator in a straight line.
- Using the calibrated manual torque wrench, tighten the nut to at least the bolt tension listed below. Record the values of the torque and tension. Torque must be measured with the nut in motion.

Table A2

|                     |     |     |     |     |    |       |       |       |       |
|---------------------|-----|-----|-----|-----|----|-------|-------|-------|-------|
| Bolt Diameter (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   |

Table A2M

|                    |    |    |     |     |     |     |     |     |     |
|--------------------|----|----|-----|-----|-----|-----|-----|-----|-----|
| Bolt Diameter (mm) | 13 | 16 | 19  | 22  | 25  | 29  | 32  | 35  | 38  |
| Tension (kN)       | 53 | 85 | 125 | 173 | 227 | 249 | 318 | 378 | 458 |

- Calculate and record the value:  $0.25 \times \text{Bolt diameter (inches)} / 12 \times \text{Tension (kips)} \times 1000$ . The torque measured and recorded in Step 4 must be equal to or less than this calculated value. Assemblies with torque values exceeding this calculated value fail the test.
- Further tighten the nut to the rotation listed below. The rotation is measured from the initial marking in Step 3. Record the bolt tension. Assemblies fail the test if stripping or fracture occurs.

Table A3

|                                     |                              |   |                                   |
|-------------------------------------|------------------------------|---|-----------------------------------|
| Bolt Length<br>(Measured in Step 1) | 4 x bolt diameter<br>or less | Greater than 4, but no more<br>than 8 x bolt diameter | Greater than 8 x<br>bolt diameter |
| Required Rotation                   | 2/3                          | 1   | 1 1/3                             |

7. The bolt tension measured in Step 6 after the required rotation must equal or exceed the values in the table listed below. Assemblies, which do not meet this tension, have failed the test.

Table A4

|                     |     |     |     |     |    |       |       |       |       |
|---------------------|-----|-----|-----|-----|----|-------|-------|-------|-------|
| Bolt Diameter (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   |

Table A4M

|                    |    |    |     |     |     |     |     |     |     |
|--------------------|----|----|-----|-----|-----|-----|-----|-----|-----|
| Bolt Diameter (mm) | 13 | 16 | 19  | 22  | 25  | 29  | 32  | 35  | 38  |
| Tension (kN)       | 62 | 98 | 142 | 200 | 262 | 285 | 365 | 436 | 525 |

8. Loosen and remove the nut, and examine the threads on the nut and bolt. No signs of thread shear failure, stripping, or torsional failure of the bolt should be evident. Assemblies, which have evidence of stripping, fail the test.