Iowa Department of Transportation

ROTATIONAL—CAPACITY TEST
Long Bolt Procedure 1-5-95
(For bolts long enough to be tested in a Skidmore.)

Test Number_____
Date_____
Inspector _____
Design #_____

County_____ Project #_____

Skidmore Correction
Calb. Ave _____kip Gauge _____kip Calb. Ave – Gauge = _____kip

Calculations
Bolt diameter *D* = _____inches 4D = _____in. 8D=_____in. Min. Adj. Tension = Min. Tension x 1.15

Fastener Type BLACK GALVANIZED
Field Relubricated for this test Yes_____ No_____

Misc. Information

R – C PROCEDURE (I.M. 453.06 B)

Bolt Length = _____ inches Read _____ kips

Corrected Skidmore Tension (P) = _____ kips

(Must be = to, or > than TABLE 2 Tension.) OK?_____

Measured Torque = _____ft-lbs

Max. Permitted Torque = _____ft-lbs T=0.25x_____" x_____lbs

T < 0.25 x dia/12 x P Measured < Max OK?_____ 12"

*** Complete R – C Test Rotation. ***

(Should bring total rotation to 2x the rotation required by Turn-of-Nut.) Read _____kips

Corrected Skidmore Tension = _____kips

(Must be > than TABLE 3 Tension) OK?_____

Condition of Fastener: Nut OK? Bolt OK? PASS?

Production Lot#
Bolts _____
Nuts _____
Washers _____
R – C Lot # _____

NOTES:

R – C Procedure from I.M. 453.06 B, Appendix A

1. Place fastener in Skidmore, use washer under "turned" element.
   Need a minimum 3 to 5 exposed treads behind the nut. (NOTE: May use a maximum of 3 washers &/or or shim plates.)
2. Initially tension fastener to values in TABLE 1.
3. Match mark bolt tip, nut corner, washer/shims, and the Skidmore's base plate. (Mark shall be a straight-line.
4. Tighten fastener to at least MINIMUM specified tension in TABLE 2. (Include any Skidmore correction factors.) This tension is required for a calculation in step 6 and is called "P" in the formula below.
   Check total rotation for step 4. Should be about the same as rotation for Turn-of-Nut.
5. Record torque required to develop tension in step 4. (Torque is read with nut in motion.)
6. Torque in step 5 must be less than "Maximum" torque.
   "Maximum" torque is calculated by T = 0.25 x bolt dia/12 x P. If step 5's torque is less than Maximum, bolt and nut pass. If not, lot fails and entire lot may be relubricated and retested or else replaced.
7. Complete nut rotation as required by R – C Rotation listed in TABLE 4.
8. Record tension at the end of step 7's added rotation. (Accounting for any Skidmore correction factors.)
   Step 8's tension must be greater than MINIMUM shown in TABLE 3. If it is greater, fastener passes.
   If not, fastener lot fails. If lot fails due to tension being less than minimum shown in TABLE 3, the entire bolt lot may be relubricated and tested again. If bolt breaks during step 7, entire bolt lot fails and shall be replaced.
9. Loosen nut, remove bolt, and inspect bolt and nut for visible signs of damage.
   Damage could be thread stripping, nut does not run freely to location of test shims, nut is cracked, bolt is cracked in the threads, etc. If there is evidence of damage, the bolt lot is rejected & shall be replaced.
10. Conduct test on two randomly selected fasteners. Both tested fasteners must pass the R-C test to accept that lot.

TABLE 1

Bolt Dia.	Initial Tension Range
3/4"	3 to 5 kips
7/8"	4 to 6 kips
1"	5 to 7 kips
1-1/8"	6 to 8 kips

TABLE 2

Bolt Dia.	Specification Min. Tension
3/4"	28.4 kip
7/8"	39.3 kip
1"	51.5 kip
1-1/8"	56.5 kip

TABLE 3

Bolt Dia.	Min. Adj. Tension
3/4"	32.7 kip
7/8"	45.2 kip
1"	59.2 kip
1-1/8"	65.0 kip

TABLE 4

Bolt Length	R – C Test Total Rotation
L ≤ 4D	2/3
4D<L ≤8D	1
8D<L ≤12D	1-1/3

Bolt Diameters Fraction	Decimal
3/4"	0.750"
7/8"	0.875
1-1/8"	1.125"

ASTM GRADES FOR	
Blk & Galv	Bolt A 325
Black	Nut A 194
Galvanized	Nut A 563
Blk & Galv	Washer F 436

Iowa Department of Transportation

ROTATIONAL—CAPACITY TEST
Short Bolt Procedure 1-5-95
(For bolts too short to be tested in a Skidmore.)

Test Number_____
Date_____
Inspector _____

County_____ Project #_____ Design #_____

Fastener Type BLACK GALVANIZED
Field Relubricated for this test Yes_____ No_____

Calculations
Bolt diameter *D* = _____inches 4D = _____in. 8D=_____in. Bolt Length = _____inches

R – C PROCEDURE (I.M. 453.06 B)

Measured Torque at Snug Tight = _____ ft-lbs
Range given in TABLE 1

Measured Torque after Initial Rotation = _____ ft-lbs
Rotation given in TABLE 2

Is Torque < TABLE 3? _____ Yes, Continue test
_____ No, R – C Lot Fails

Complete R – C Test Rotation.
Total rotation required by R – C test given in TABLE 4.

Condition of Fastener: Nut OK? _____, Bolt OK? _____, PASS? _____

Production Lot#
Bolts _____
Nuts _____
Washers _____
R – C Lot # _____

NOTES:

R – C Procedure from I.M. 453.06 B, Appendix A

1. Place fastener into an appropriate size hole in any available splice. Use washer/shims under "turned" element. Need a minimum 3 to 5 exposed threads behind the nut. (NOTE: May use a maximum of 3 washers &/or shim plates.)
2. Initially tension fastener to values listed in TABLE 1.
3. Match mark bolt tip, nut corner, washer/shims, and the base steel. (Mark shall be a straight line.)
4. Tighten fastener to rotation specified in TABLE 2.
   NOTE: Same rotation required for Turn-of-Nut.
5. Record torque when rotation in Step 4 is achieved. (Torque is read with nut in motion.)
6. Torque shall not exceed values in TABLE 3. If Step 5's torque is LESS THAN "Maximum" allowable, fastener lot passes first phase of R – C testing. If torque is GREATER, fastener lot fails. Entire lot may be relubricated and retested or else lot is replaced and tested.
7. Complete nut rotation to total rotation required by TABLE 4. NOTE: Rotation is measured from initial reference marked in Step 3 and is 2 times the rotation required for Turn-of-Nut.
8. Loosen nut, remove bolt, and inspect bolt and nut for visible sighs of damage.
   Damage could be thread stripping, nut does not run freely to location of test shims, nut is cracked, bolt is Cracked in the threads, etc. If there is evidence of damage, the bolt lot is rejected. Entire lot may be Relubricated and retested or else replaced and tested.
9. Conduct test on two randomly selected fasteners for each lot to be incorporated into the structure.
   Both tested fasteners must pass the R – C test to accept that lot.

Misc. Information

TABLE 1

Bolt Dia.	Initial Tension Range (ft-lbs)
3/4"	50 to 100
7/8"	80 to 160
1"	120 to 240
1-1/8"	150 to 300

TABLE 2

Bolt Length	Initial R – C (Turns)
L ≤ 4D	1/3
4D<L ≤8D	1/2
8D<L ≤12D	2/3

TABLE 3

Bolt Dia.	Max. Torque (ft-lbs)
5/8"	290
3/4"	500
7/8"	820
1"	1230
1-1/8"	1500

TABLE 4

Bolt Length	Total R – C Turns
L ≤ 4D	2/3
4D<L ≤8D	1
8D<L ≤12D	1-1/3

Bolt Diameters	
Fraction	Decimal
5/8"	0.625"
3/4"	0.750"
7/8"	0.875"
1-1/8"	1.125"

ASTM GRADES FOR	
Blk & Galv	Bolt A 325
Black	Nut A 194
Galvanized	Nut A 563
Blk & Galv	Washer F 436

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Test Number_____
Date_____
Inspector _____
Design #_____

County_____ Project #_____

Skidmore Correction
Calb. Ave _**306**_ kip Gauge **30.0** kip
Calb. Ave – Gauge = __**+0.6**____kip

Calculations
Bolt diameter *D* = _____**3/4**____inches
4D = ____**3**_____in. 8D=_____**6**___in.
Min. Adj. Tension = Min. Tension x 1.15

Fastener Type (BLACK) ~~GALVANIZED~~
Field Relubricated for this test Yes___**X**__ No_____

Misc. Information

R – C PROCEDURE (I.M. 453.06 B)

Bolt Length = ____**3**_____ inches Read ___**28.4**___ kips

Corrected Skidmore Tension (P) = _**28.4 + 0.6 = 29.0**_____ kips

(Must be = to, or > than TABLE 2 Tension.) OK?__**Yes**_

Measured Torque = _____**350**_____ft-lbs

Max. Permitted Torque = ____**453**_____ft-lbs T=0.25x_**0.75**__" x_**29,000** bs

T < 0.25 x dia/12 x P Measured < Max OK?_**Yes** 12"

*** Complete R – C Test Rotation. ***

(Should bring total rotation to 2x the rotation required by Turn-of-Nut.) Read _**40.0**___kips

Corrected Skidmore Tension = _**40.0 + 0.6 = 40.6**_____kips

(Must be > than TABLE 3 Tension) OK?_**Yes**__

Condition of Fastener: Nut OK? **Yes** Bolt OK? **Yes** PASS? **Yes**

Production Lot#
Bolts _____
Nuts _____
Washers _____
R – C Lot # _____

NOTES:

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