

**Standard Method of Test for
High Strength Bolt Assemblies with Direct Tension
Indicator Verification**

SCDOT Designation: SC-T-135 (7/09)

1. SCOPE

Testing verifies assemblies' results furnished by the manufacturer or distributor.

2. REFERENCED DOCUMENTS

2.1 ASTM Standards

A 325 Specification for High-Strength Bolts for Structural Steel Joints

A 563 Specification for Carbon and Alloy Steel Nuts

F 436 Specification for Hardened Steel Washers

F 606 Test Methods for Determining the Mechanical Properties of
Externally and Internally Threaded Fasteners, Washers, and Rivets

F 959 Specification for Compressible-Washer Type Direct Tension
Indicators for Use with Structural Fasteners

2.2 SCDOT Standards

Current Edition of South Carolina Department of Transportation
Specifications for Highway Construction

3. APPARATUS

3.1 Skidmore-Wilhelm Calibrator

3.2 Torque Wrench

3.3 Tapered Leaf Thickness Gauge 0.005 inch

3.4 Wrench for Bolt Head

3.5 Markers

3.6 Rockwell Hardness Tester

3.7 Coating Thickness Gauge

3.8 Charts for length to size installation and test requirements for tension and
torque readings

3.9 Mill Test Reports

3.10 Manufacturer certified test report or distributor certified test report

4. TEST SPECIMENS

4.1 Three assemblies of each combination of materials including bolt production

5.16 Tighten nut to 1.05 times the proof load with another wrench on bolt head to prevent rotation of the head against the DTI which can be taken from table below.

Bolt Tension (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
M164 (A325) 108		13	20	29	41	54	59	75	89
M253 (A490)	NA	NA	37	51	67	84	107	127	NA

5.17 Determine and record the number of spaces between the protrusion on the DTI that a 0.005 in. thickness gage is refused. The total number of spaces in the various sizes and grade of DTI's is shown below.

Number of Spaces

Bolt Dia (in)	1/2	5/8	3/4	7/8	1	1 1/8	1 1/4	1 3/8	1 1/2
M164 (A325) 8		4	4	5	5	6	6	7	7
M253 (A490)	NA	NA	6	6	7	7	8	8	NA

5.18 The number of spaces which the 0.0005 in. gage is refused should not exceed the number given in the table below. If the number of spaces exceeds the number in the table, the DTI fails the verification test.

Verification Criteria

Number of spaces in washer	4	5	6	7	8
Maximum number of spaces gage is refused 3	1	2	2	3	

5.19 Tighten bolt until the 0.005 in. gage is refused at all spaces but a visible gap exists and record compression strength.

5.20 Calculate 95% of tension from 5.11.

- 5.21 Remove the fastener from the calibrator and turn the nut on the threads of the bolt by hand through the full length of the threads.
- 5.22 DTI is satisfactory if the compressive strength of the DTI is between strengths from 5.16 and 5.20 and nut goes full length in 5.21.

6. CALCULATIONS

$$45 \text{ Kips} \times 0.95 = 42.8 \text{ Kips}$$

$$45 \text{ Kips} \times 1.05 = 47.3 \text{ Kips}$$

7. REPORT

Test results are reported on Lab Form 947. Data and calculations are recorded on worksheet 947W.