



Connecticut DOT

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## ENGINEERING & CONSTRUCTION BULLETIN

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Chief Engineer

### **Owned Special Provisions Sections 6.03 (Structural Steel) and M.06 (Metals)**

Updates to ASTM specifications for Anchor Bolts, High-Strength Bolts and Galvanizing were adopted into the latest AASHTO LRFD Bridge Design Specifications resulting in revisions to the following Form 817 Sections of the Standard Specifications (included as Errata in the January 2018 Supplements):

- 9.47 - Bus Passenger Shelter
- M.10 - Railing and Fence
- M.15 - Highway Illumination
- M.16 - Traffic Control Signals
- M.18 - Signing

The following revisions to Sections 6.03 - Structural Steel and M.06 - Metals were more extensive and are included in the attached Owned Special Provisions.

- 1) In 6.03.03-4(f) High-Strength Bolted Connections:
  - a) ASTM A325 and A490 specifications for bolts have been bundled into ASTM F3125 and will be designated as "Grades" under the new specification.
  - b) The strength requirements for all diameters of Grade A325 bolts has been changed to 120 ksi under ASTM F3125, the required Minimum Bolt Tension of bolts over 1 inch diameter has increased (see 6.03.03-4(f), Table A).
  - c) Field procedure requirements for Rotational-Capacity Tests are now found in ASTM F3125 Annex A2. Rotational Capacity Test requirements have changed.

- 2) In M.06:
  - a) M.06.02-2 Anchor Bolts: ASTM F1554 anchor bolts requires coating to meet the standards of ASTM F2329 which is specifically for zinc coating and hot-dip galvanizing of threaded fasteners.
  - b) M.06.02-3 High-Strength Bolts: See 1a above and the following:
    - i) Only suitable grades of coated nuts compatible with Grade A325 and Grade A490 coated high-strength bolts are now specified.
    - ii) The requirements for identifying marks have been updated, including requirement that markings be raised or depressed to be visible after coating, if coating is required.
    - iii) ASTM F2329 is appropriate (not A153) for zinc coating and hot-dip galvanizing of steel bolts, screws, washers, nuts and special threaded fasteners.
    - iv) ASTM B695 Class 55 (not Class 50) is a permitted coating for washers used with high-strength bolts.
    - v) The test requirements related to maximum hardness have been updated and wedge tests of full-size bolts are under Section 10.1 of ASTM F3125.
  - c) M.06.03 Galvanizing: Addition of ASTM F2329 to list of zinc coating requirement standards. Class 55 (not Class 50) is the updated mechanical galvanizing standard in ASTM B695.

These special provisions are to be used in all contracts that have pay item numbers that begin with 0603 or include specifications that refer to Sections 6.03 or M.06.

These special provisions will be posted on the Owned Special Provisions webpage until they are incorporated into an upcoming supplement to Form 817.

Attachments (Owned Special Provisions)

**SECTION 6.03 - STRUCTURAL STEEL**

Section 6.03 is amended as follows:

**6.03.03—Construction Methods:** *Revise Subarticle 4(f) “High Strength Bolted Connections” as follows:*

*Replace the first paragraph and Table A: "Minimum Bolt Tension in kips" with the following:*

" The assembly of structural connections using high-strength bolts shall be installed so as to develop the minimum required bolt tension specified in Table A. The Manufacturer’s certified test report; including the rotational capacity test results must accompany the fastener assemblies. Fastener Assemblies delivered without the certified reports will be rejected.

**Table A: Minimum Bolt Tension in kips\***

<b><u>Bolt Diameter (Inches)</u></b>	<b><u>ASTM F3125 Grade A325</u></b>	<b><u>ASTM F3125 Grade A490</u></b>
5/8	19	24
3/4	28	35
7/8	39	49
1	51	64
1 1/8	64	80
1 1/4	81	102
1 3/8	97	121
1 1/2	118	148

\*Equal to 70% of specified minimum tensile strength of bolts (as specified in ASTM Specifications for tests of full-size F3125 Grade A 325 and F3125 Grade A 490 bolts with UNC threads, loaded in axial tension) rounded to the nearest kip.

*Revise the last sentence of the sixteenth paragraph, "Rotational-Capacity Tests" as follows:*

" When performed in the field, the procedure shall meet the requirements of ASTM F3125 Annex A2."

*In Table C, insert the word "Grade" in the third row before every occurrence of "A325" and "A490."*

## **SECTION M.06 - METALS**

Section M.06 is amended as follows:

### **M.06.01—Reinforcing Steel:**

*Delete the entire last paragraph in Subarticle 1 "Bar Reinforcement" that reads: "Prior to the incorporation... ..and type of bar reinforcement."*

### **M.06.02—Structural Steel:**

*Revise Subarticle 2 "Anchor Bolts" as follows:*

"(a) Anchor bolt assemblies shall meet the requirements of ASTM F1554, and the grade shall be as specified on the plans. All components of the bolt assembly shall be galvanized in accordance with ASTM F2329."

*Replace Subarticle 3 "High Strength Bolts" with the following:*

" **3. High-Strength Bolts:** High-strength bolts, including suitable nuts and hardened washers, shall meet the following requirements:

- (a) High-strength bolts shall meet the requirements of ASTM F3125 Grade A325 or ASTM F3125 Grade A490 as shown on the plans. High-strength bolts used with coated steel shall be mechanically galvanized, unless otherwise specified. High-strength bolts used with uncoated weathering grades of steel shall be Type 3.

Nuts for ASTM F3125 Grade A325 bolts shall meet the requirements of ASTM A563, Grades DH, DH3, C, C3 and D. Where galvanized high-strength bolts are used, the nuts shall be galvanized, heat-treated Grade DH. Where Type 3 high-strength bolts are used, the nuts shall be Grade C3 or DH3.

Nuts for ASTM F3125 Grade A490 bolts shall meet the requirements of ASTM A563, Grade DH. Where Type 3 high-strength bolts are used, the nuts shall be Grade DH3.

All galvanized nuts shall be lubricated with a lubricant containing a visible dye of any color that contrasts with the color of the galvanizing. Black bolts must be oily to the touch when delivered and installed.

Circular flat and square or rectangular beveled, hardened steel washers shall meet the requirements of ASTM F436. Unless otherwise specified, galvanized washers shall be furnished when galvanized high-strength bolts are specified, and washers with atmospheric corrosion resistance and weathering characteristics shall be furnished when Type 3 high-strength bolts are specified.

Compressible-washer-type direct tension indicator washers, used in conjunction with high-strength bolts, shall meet the requirements of ASTM F959. Where galvanized high-strength bolts are used, the washers shall be galvanized in accordance with ASTM B695,

Class 55. Where Type 3 high-strength bolts are used, the washers shall be galvanized in accordance with ASTM B695, Class 55 and coated with epoxy.

- (b) Identifying Marks:** ASTM F3125 Grade A325 for bolts and the specifications referenced therein for nuts require that bolts and nuts manufactured to the specification be identified by specific markings on the top of the bolt head and on one face of the nut. Markings may be raised or depressed at the manufacturer's option and shall be visible after coating if coating is required. Head markings must identify the grade by the symbol "A325," the manufacturer and the type, if Type 3. Nut markings must identify the grade, the manufacturer and if Type 3, the type. Markings on direct tension indicators must identify the manufacturer and Type "A325." Other washer markings must identify the manufacturer and if Type 3, the type.

ASTM F3125 Grade A490 for bolts and the specifications referenced therein for nuts require that bolts and nuts manufactured to the specifications be identified by specific markings on the top of the bolt head and on one face of the nut. Markings may be raised or depressed at the manufacturer's option and shall be visible after coating if coating is required. Head markings must identify the grade by the symbol "A490," the manufacturer and the type, if Type 3. Nut markings must identify the grade, the manufacturer and if Type 3, the type. Markings on direct tension indicators must identify the manufacturer and Type "A490." Other washer markings must identify the manufacturer and if Type 3, the type.

ASTM F3125 Grade A325 and ASTM F3125 Grade A490 bolt lengths up to 4 times the diameter which are fully threaded but which are not required to be fully threaded by the relevant ASME standard shall be marked with a "T" immediately after the grade designation, for example "A325T." Bolts with any other non-standard dimensions, including thread length, shall be marked with an "S" immediately after the grade designation, for example "A325S." All other markings, if used, such as a private label distributor's mark shall also be separate and distinct.

- (c) Dimensions:** Bolt and nut dimensions shall meet the requirements for Heavy Hexagon Structural Bolts and for Heavy Semi-Finished Hexagon Nuts given in ASME Standard B18.2.6.
- (d) Galvanized Bolts:** Galvanized bolts shall meet the requirements of ASTM F3125 Grade A325, Type 1. The bolts shall be hot-dip galvanized in accordance with ASTM F2329, to a thickness of 50  $\mu\text{m}$  or mechanically galvanized in accordance with ASTM B695, Class 55. Bolts, nuts, and washers of any assembly shall be galvanized by the same process. The nuts shall be overtapped to the minimum amount required for the fastener assembly, and shall be lubricated with a lubricant containing a visible dye so a visual check can be made for the lubricant at the time of field installation. Galvanized bolts shall be tension tested after galvanizing. ASTM F3125 Grade A490 bolts shall be uncoated or shall be coated in accordance with either ASTM F1136 Grade 3 or ASTM F2833 Grade 1.
- (e) Test Requirements:** The maximum hardness of ASTM F3125 Grade A325 bolts shall be 34 HRC. The maximum hardness of ASTM F3125 Grade A490 bolts shall be 38 HRC.

Plain, ungalvanized nuts shall have a minimum hardness of 89 HRB.

Proof load tests, in accordance with the requirements of ASTM F606 Method 1, shall be required for the bolts. Wedge tests of full-size bolts are required in accordance with Section 10.1 of ASTM F3125. Galvanized bolts shall be wedge tested after galvanizing. Proof load tests of ASTM A563 are required for nuts. Proof load tests for nuts used with

galvanized bolts shall be performed after galvanizing, overtapping and lubricating.

Rotational-capacity tests are required and shall be performed on all plain or galvanized (after galvanizing) bolt, nut and washer assemblies by the manufacturer or distributor prior to shipping and by the Contractor at the Site.

The thickness of galvanizing on bolts, nuts and washers shall be measured. On bolts, it shall be measured on the wrench flats or on top of the bolt head, and on nuts it shall be measured on the wrench flats.

- (f) **Certified Test Reports and Materials Certificates:** The Contractor shall submit notarized copies of Certified Test Reports and Materials Certificates in accordance with Article 1.06.07 for fastener assemblies. In addition the Certified Test Reports and Materials Certificates shall include the following:
1. Mill test reports shall indicate the place where the material was melted and manufactured.
  2. Test reports for proof load tests, wedge tests, and rotational-capacity tests shall indicate where the tests were performed, date of tests, location of where the components were manufactured and lot numbers.
  3. The test report for galvanized components shall indicate the thickness of the galvanizing.
- (g) **Material Samples:** Prior to incorporation into the work, the Contractor shall submit samples of the bolt assemblies to the Engineer for testing in accordance with the latest edition of the "[Materials Testing Manual](#) (Chapter 8, Minimum Schedule for Acceptance Testing)." Samples shall be submitted for each diameter, length, material designation, grade, coating and manufacturer of bolt assembly."

### **M.06.03—Galvanizing:**

*Replace the entire subarticle with the following:*

" **M.06.03—Galvanizing:** Unless otherwise specified on the plans or in the special provisions, the zinc coating on all iron and steel materials, other than wire, shall meet the requirements of ASTM A123, A153 or F2329, whichever shall apply.

When mechanical galvanizing is used it shall meet the requirements of ASTM B695 Class 55."