

1616 - STEEL FASTENERS

SECTION 1616

STEEL FASTENERS

1616.1 DESCRIPTION

This specification governs threaded and non-threaded fastener components and the requirements for their corrosion protection.

1616.2 REQUIREMENTS

a. General. Provide fastener components and coatings that comply with **subsection 1616.2b** unless specified otherwise on the Contract Documents. For threaded fastener components, comply with the thread series of ANSI/ASME B1.1 Coarse Thread Series, with a tolerance class that accommodates the corrosion protective coating when applicable.

b. Material Specifications.

(1) Provide externally threaded steel fasteners intended for general applications that comply with ASTM A 307 inclusive of the Appendices. The property grade specified is to be dictated by the intended application, nominal size, and availability, however Grade A is recommended for most purposes. Provide nuts intended for use with these fasteners that comply with ASTM A 563 inclusive of the Appendices. Provide nuts that are also compatible with the Grade of externally threaded fastener according to the guidelines of ASTM A 563 for the property grade and design style of the nut. Test all nuts for compliance with their respective property grade requirements of ASTM A 563 regardless of application. Provide plain, or flat, washers for use with these fastener components that comply with ANSI/ASME B18.22M, Type A or Type B, and ASTM F 844. Determine the washer type and series by the intended application. When atmospheric corrosion resistant steel is required, all fastener assembly components are to be produced from weathering steel.

(2) Provide externally threaded steel fasteners for applications where high strength is a prerequisite that meet ASTM A 325 for Type 1, or Type 3 when the formation of a protective oxide coating is required for protection from atmospheric corrosion. Provide nuts intended for use with these fasteners are to be of a property grade specified by ASTM A 325 that comply with ASTM A 563 inclusive of the Appendices. Provide nuts that are also compatible with the Grade of externally threaded fastener according to the guidelines of ASTM A 563 for the property grade and design style of the nut. Test all nuts for compliance with their respective property grade requirements of ASTM A 563 regardless of application. Provide plain, or flat, washers for use with these fastener components as specified by ASTM A 325 and comply with ASTM F 436. Externally threaded steel fasteners that comply with ASTM A 490, magnetic particle inspection (MPI) requirement waived, and nuts that comply with ASTM A 194 may be utilized in lieu of A 325 and A 563 components. When atmospheric corrosion resistant steel is required, all fastener assembly components are to be produced from weathering steel.

(3) Provide all high strength steel bolts, nuts, and washers that comply with the rotational capacity test requirements of the 3rd edition (with Interim Specifications) of the AASHTO LRFD Bridge Construction Specifications, Section 11.5.6.4.2. The rotational capacity test procedures, as developed by the FHWA, are presented in KT-MR11, Rotational Capacity Testing of High Strength Fasteners.

(4) When specified, provide lock washers that comply with ASME B18.22.1. Determine the washer type and series by the intended application.

(5) Provide Direct Tension Indicators (DTI) for high strength applications, or when specified in the contract documents, that comply with the requirements of ASTM F 959. Use "plain" Type 325 and Type 490 DTI's with ASTM A 325 Type 1 and A 490 Type 1 structural bolts, respectively. Use "weathering steel" Type 325-3 and Type 490-3 DTI's with ASTM A 325 Type 3 and A 490 Type 3 structural bolts, respectively.

Incorporate circumferential indentations or edge notches on the exposed face of the DTI which are aligned with feeler gage entry points. Indentations or notches shall be clearly visible after installation of the DTI, but not so large as to interfere with the function of the DTI.

(6) Provide steel structural rivets that comply with ASTM A 502 for Grade 1 or Grade 2, or Grade 3 when the formation of a protective oxide coating is required for protection from atmospheric corrosion. Dimensions and design type are to be as specified for the intended application.

(7) Miscellaneous fastener components not specifically addressed in this subsection are to comply with the applicable AASHTO, ASTM, ASME, ANSI, or other governing component or material specifications with the consensus of the component manufacturer and the KDOT.

1616 - STEEL FASTENERS

(8) When corrosion protection coatings are specified for fastener components, provide components that are zinc coated and in compliance with ASTM F 2329 for hot dip galvanizing or by the mechanical deposition of a zinc coating in compliance with ASTM B 695, Class 50. Fastener components of nominal size of less than 13 mm diameter may be zinc coated by an electrodeposition process. The coating is to be uniform, comply with ASTM B 633, and have a thickness in the range of 5 to 8 micrometers for use under mild to moderate service conditions, SC 1 to SC 2. Note that an electrodeposited zinc coating thickness in excess of 8 micrometers may result in thread fit interference. Electrodeposited cadmium coating is also permitted when in compliance with ASTM B 766 and the same thickness range constraints as for electrodeposited zinc coating. Aluminum coating is acceptable when permitted and regulated by the specification that governs the component.

(9) In lieu of a separate nut, washer, and DTI, provide a combined nut and DTI assembly for use with high strength structural bolts. The nut component shall comply with **subsection 1616.2b.(2)** and the DTI component shall comply with **subsection 1616.2b.(5)**. Manufacture each lot of assemblies using a single DTI lot and a single nut lot. Identify assembly lots using the lot of the component DTIs.

Unless the contract documents indicate otherwise, an F 436 washer need not be used when a bolt and combined nut/DTI assembly are used and all of the following are satisfied:

- The fastener is used with a standard size hole.
- The bolt is not the turned fastener component.
- The combined nut/DTI manufacturer's installation instructions and product literature demonstrate satisfactory performance without the use of a hardened washer.
- The pre-installation verification testing demonstrates satisfactory performance without the use of a hardened washer.

(10) Provide all high strength structural bolts and combined nut/DTI assemblies that comply with the rotational capacity test requirements of **subsection 1616.2b.(3)**, modified to account for the flattening of protrusions on the DTI component of the assembly.

1616.3 TEST METHODS

Conduct all tests required by the applicable AASHTO, ASTM, ASME, ANSI, or other component or material specifications of **subsection 1616.2b**. Coating thickness may be measured by any one of the methods specified in ASTM B 633 and by eddy current methods, ASTM E 376 (B 244 may also be useful as a technique guideline), provided that appropriate calibration procedures and standards have been applied. The magnetic induction and eddy current methods are nondestructive in nature and are preferred. Destructive techniques, i.e., coating removal, may be utilized as referee methods.

Conduct rotational capacity testing on all coated and non-coated high strength threaded fastener component assemblies referenced in **subsection 1616.2b(3)**.

1616.4 PREQUALIFICATION

Not applicable.

1616.5 BASIS OF ACCEPTANCE

Submit for approval a Type A certification, as specified in **DIVISION 2600**, for all fastener components provided through this specification. In addition, provide certifications for DTI's showing the results of ASTM F 606 testing. A combined nut/DTI assembly requires a certification for each of its components.

Compliance of samples of all fastener components utilized for overhead lighting and signing, sign supports, bridge beam connections and splices, and any other application considered relevant by the Engineer's representative with **subsection 1616.2b**. Provide representative samples of the lot(s) and heat(s) of the components and materials, including combined nut/DTI assemblies (but not separate DTIs). Submit the samples to the Engineer of Tests for testing. Samples for testing are not required for fastener components used to attach sign panels to ground mounted sign supports nor for components used in break-away connections on ground mounted sign supports.

The KDOT representative will inspect all fastener components for compliance with corrosion protection, marking, and dimensional requirements.

The final disposition of fastener components will be completed at the final destination as the result of inspection for the quality of workmanship, the delivery condition.