
Standard Specification for

Structural Bolts, Alloy Steel, Heat-Treated, 150 ksi Minimum Tensile Strength

AASHTO Designation: M 253-05 (2008)

ASTM Designation: A 490-04a



AASHTO M 253-05 (2008) is identical to ASTM A 490-04a except for the following provisions:

1. All references to the ASTM standards contained in ASTM A 490-04a, listed in the following table, shall be replaced with the corresponding AASHTO standard.

<i>Referenced Standards</i>	
ASTM	AASHTO
A 194	M 292M/M 292
A 325	M 164
A 563	M 291
A 709	M 270M/M 270
F 436	M 293

2. In Section 15.1 of ASTM A 490-04a, change the phrase “furnish the purchaser a test report” to “furnish the purchaser a certified test report.”
3. Replace Section 16.1 of ASTM A 490-04a with the following:
16.1 The party responsible for the fastener shall be the organization that supplies the fastener to the purchaser. The responsible party shall supply test reports, certified by the manufacturer, that indicate the fasteners were manufactured, sampled, tested, and inspected in accordance with this specification and all of its requirements.
4. Replace Note 4 with the following:
Note 4—ASTM F 788/F 788M and F 1470 do not guarantee 100 percent freedom from nonconforming head bursts. Sampling is designed to provide a 95 percent confidence level of freedom from nonconforming head bursts in any test lot. Head bursts within the limits in ASTM F 788/F 788M are unsightly but do not affect mechanical properties or functional requirements of the bolt. Bolts exhibiting head bursts that do not meet the physical requirements of ASTM F 788/F 788M are rejectable.



Standard Specification for Structural Bolts, Alloy Steel, Heat Treated, 150 ksi Minimum Tensile Strength¹

This standard is issued under the fixed designation A 490; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

This standard has been approved for use by agencies of the Department of Defense.

1. Scope*

1.1 This specification covers two types of quenched and tempered, alloy steel, heavy hex structural bolts having a tensile strength of 150 to 173 ksi.

1.2 These bolts are intended for use in structural connections. These connections are covered under the requirements of the Specification for Structural Joints Using Specification A 325 or A 490 bolts, approved by the Research Council on Structural Connections; endorsed by the American Institute of Steel Construction and by the Industrial Fastener Institute.²

1.3 The bolts are furnished in sizes ½ to 1½ in., inclusive. They are designated by type denoting chemical composition as follows:

Type	Description
Type 1	Medium carbon alloy steel
Type 2	Withdrawn in 2002
Type 3	Weathering steel

1.4 This specification provides that heavy hex structural bolts shall be furnished unless other dimensional requirements are specified on the purchase order.

1.5 Terms used in this specification are defined in Terminology F 1789 unless otherwise defined herein.

1.6 For metric bolts, see Specification A 490M Classes 10.9 and 10.9.3

1.7 The following safety hazards caveat pertains only to the Test Methods portion, Section 12 of this specification: *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

¹ This specification is under the jurisdiction of ASTM Committee F16 on Fasteners and is the direct responsibility of Subcommittee F16.02 on Steel Bolts, Nuts, Rivets, and Washers.

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² Available from American Institute of Steel Construction (AISC), One E. Wacker Dr., Suite 3100, Chicago, IL 60601-2001.

2. Referenced Documents

2.1 ASTM Standards:³

- A 194/A 194M Specification for Carbon and Alloy Steel Nuts for Bolts for High-Pressure and High-Temperature Service
- A 325 Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
- A 354 Specification for Quenched and Tempered Alloy Steel Bolts, Studs, and Other Externally Threaded Fasteners
- A 490M Specification for High-Strength Steel Bolts, Classes 10.9 and 10.9.3, for Structural Steel Joints [Metric]
- A 563 Specification for Carbon and Alloy Steel Nuts
- A 751 Test Methods, Practices, and Terminology for Chemical Analysis of Steel Products
- D 3951 Practice for Commercial Packaging
- E 384 Test Method for Microindentationhardness of Materials
- E 709 Guide for Magnetic Particle Examination
- E 1444 Practice for Magnetic Particle Inspection
- 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 788/F 788M Specification for Surface Discontinuities of Bolts, Screws, and Studs, Inch and Metric Series
- F 959 Specification for Compressible-Washer-Type Direct Tension Indicators for Use with Structural Fasteners
- F 1470 Guide for Fastener Sampling for Specified Mechanical Properties and Performance Inspection
- F 1789 Terminology for F16 Mechanical Fasteners
- G 101 Guide for Estimating the Atmospheric Corrosion Resistance of Low-Alloy Steels

³ For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

*A Summary of Changes section appears at the end of this standard.

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2.2 ASME Standards:⁴

B1.1 Unified Screw Threads

B18.2.6 Fasteners for Use in Structural Applications

B18.24.1 Part Identifying Number (PIN) Code System

2.3 SAE Standard:⁵

J121 Decarburization in Hardened and Tempered Threaded Fasteners

3. Ordering Information

3.1 Orders for heavy hex structural bolts under this specification shall include the following:

3.1.1 Quantity (number of pieces of bolts and accessories);

3.1.2 Size, including nominal bolt diameter, thread pitch, and bolt length. The thread length shall not be changed;

3.1.3 Name of product: heavy hex structural bolts, or other such bolts as specified;

3.1.4 Type of bolt (Type 1 or 3). When type is not specified, either Type 1 or Type 3 shall be furnished at the supplier's option;

3.1.5 ASTM designation and year of issue,

3.1.6 Other components such as nuts, washers, and washer-type direct tension indicators, if required;

3.1.7 Test Reports, if required (see 15); and

3.1.8 Special requirements.

3.1.9 For establishment of a part identifying system, see ASME B18.24.1.

NOTE 1—A typical ordering description follows: 1000 pieces 1–8 in. dia × 4 in. long heavy hex structural bolt, Type 1, *ASTM A 490 – 02*; each with two hardened washers, ASTM F 436 Type 1; and one heavy hex nut, ASTM A 563 Grade DH.

3.2 Recommended Nuts:

3.2.1 Nuts conforming to the requirements of Specification A 563 are the recommended nuts for use with Specification A 490 heavy hex structural bolts. The nuts shall be of the class and have a surface finish for each type of bolt as follows:

Bolt Type and Finish	Nut Class and Finish
1, plain (uncoated)	A 563—DH, DH3 plain (uncoated)
3, weathering steel	A 563—DH3, weathering steel

3.2.2 Alternatively, nuts conforming to Specification A 194/A 194M Gr. 2H plain (uncoated) are considered a suitable substitute for use with Specification A 490 Type 1 heavy hex structural bolts.

3.3 *Recommended Washers*—Washers conforming to Specification F 436 are the recommended washers for use with Specification A 490 heavy hex structural bolts. The washers shall have a surface finish for each type of bolt as follows:

Bolt Type and Finish	Washer Finish
1, plain (uncoated)	plain (uncoated)
3, weathering steel	weathering steel

3.4 *Other Accessories*—When compressible washer type direct tension indicators are specified to be used with these bolts, they shall conform to Specification F 959 Type 490.

⁴ Available from American Society of Mechanical Engineers (ASME), ASME International Headquarters, Three Park Ave., New York, NY 10016-5990.

⁵ Available from Society of Automotive Engineers (SAE), 400 Commonwealth Dr., Warrendale, PA 15096-0001.

4. Materials and Manufacture

4.1 *Heat Treatment*—Type 1 and Type 3 bolts shall be heat treated by quenching in oil from the austenitic temperature and then tempered by reheating to a temperature of not less than 800°F.

4.2 Threading:

The threads shall be cut or rolled.

4.3 *Protective Coatings*—The bolts shall not be coated by hot-dip zinc coating, mechanical deposition, or electroplating with zinc or other metallic coatings (Note 2).

NOTE 2—For more detail see the H. E. Townsend Report “Effects of Zinc Coatings on Stress Corrosion Cracking and Hydrogen Embrittlement of Low Alloy Steel,” published in Metallurgical Transactions, Vol. 6, April 1975.

5. Chemical Composition

5.1 Type 1 bolts shall be alloy steel conforming to the chemical composition specified in Table 1. The steel shall contain sufficient alloying elements to qualify it as an alloy steel (see Note 3).

NOTE 3—Steel is considered to be alloy by the American Iron and Steel Institute when the maximum of the range given for the content of alloying elements exceeds one or more of the following limits: manganese, 1.65 %; silicon, 0.60 %; copper, 0.60 %; or in which a definite range or a definite minimum quantity of any of the following elements is specified or required within the limits of the recognized field of constructional alloy steels: aluminum, chromium up to 3.99 %, cobalt, columbium, molybdenum, nickel, titanium, tungsten, vanadium, zirconium, or any other alloying elements added to obtain a desired alloying effect.

5.2 Type 3 bolts shall be weathering steel conforming to the chemical composition requirements in Table 2. See Guide G 101 for methods of estimating the atmospheric corrosion resistance of low alloy steel.

5.3 Product analyses made on finished bolts representing each lot shall conform to the product analysis requirements specified in Table 1 or Table 2, as applicable.

5.4 Heats of steel to which bismuth, selenium, tellurium, or lead has been intentionally added shall not be used for bolts furnished to this specification. Compliance with this requirement shall be based on certification that steels having these elements intentionally added were not used.

5.5 Chemical analyses shall be performed in accordance with Test Methods, Practices, and Terminology A 751.

6. Mechanical Properties

6.1 *Hardness*—The bolts shall conform to the hardness specified in Table 3.

6.2 Tensile Properties:

TABLE 1 Chemical Requirements for Type 1 Bolts

Element	Heat Analysis, %	Product Analysis, %
Carbon		
For sizes through 1½ in.	0.30–0.48	0.28–0.50
For size 1½ in.	0.35–0.53	0.33–0.55
Phosphorus, max	0.040	0.045
Sulfur, max	0.040	0.045
Alloying Elements	→ See 5.1 ←	