
Standard Specification for

High-Strength Steel Bolts, Classes 10.9 and 10.9.3, for Structural Steel Joints [Metric]

AASHTO Designation: M 253M-05

ASTM Designation: A 490M-04a



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

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

<i>Referenced Standards</i>	
ASTM	AASHTO
A 563M	M 291M
A 709M	M 270M/M 270

2. Section 16.1 of ASTM A 490M-04a, change the phrase “furnish the purchaser a test report” to “furnish the purchaser a certified test report.”
3. Add the following section after Section 19.1.1 of ASTM A 490M-04a as follows:
“19.1.1.1 When zinc-coated nuts are included on the same order as zinc-coated bolts, the bolts and nuts shall be shipped in the same container.”
4. Replace Note 3 with the following:
Note 3—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.



Designation: A 490M – 04a

METRIC

Standard Specification for High-Strength Steel Bolts, Classes 10.9 and 10.9.3, for Structural Steel Joints [Metric]¹

This standard is issued under the fixed designation A 490M; 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, metric heavy hex structural bolts having a tensile strength of 1040 to 1210 MPa.

1.2 These bolts are intended for use in structural connections comparable to those covered under the requirements of the Specification for Structural Joints Using ASTM A 325 and 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 nominal bolt diameters M12 to M36, 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 is applicable to metric heavy hex structural bolts and alternate designs as established by the Research Council in its publication, Specification for Structural Joints Using ASTM A 325 and A 490 bolts.

1.5 For inch-pound bolts, see Specification A 490.

1.6 The following safety hazards caveat pertains only to the Test Methods portion, Section 13, 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 325 Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength

A 490 Specification for Structural Bolts, Alloy Steel, Heat Treated, 150 ksi Minimum Tensile Strength

A 563M Specification for Carbon and Alloy Steel Nuts [Metric]

A 751 Test Methods, Practices, and Terminology for Chemical Analysis of Steel Products

D 3951 Practice for Commercial Packaging

E 384 Test Method for Microindentation Hardness of Materials

E 709 Guide for Magnetic Particle Examination

E 1444 Practice for Magnetic Particle Examination

F 436M Specification for Hardened Steel Washers [Metric]

A 490M Specification for High-Strength Steel Bolts, Classes 10.9 and 10.9.3, for Structural Steel Joints [Metric]

F 568M Specification for Carbon and Alloy Steel Externally Threaded Metric Fasteners [Metric]

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

F 788/F 788M Specification for Surface Discontinuities of Bolts, Screws, and Studs, Inch and Metric Series

F 959M Specification for Compressible-Washer-Type Direct Tension Indicators for Use with Structural Fasteners [Metric]

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

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

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TABLE 1 Chemical Requirements for Type 1 Bolts

Element	Heat Analysis, %	Product Analysis, %
Carbon		
For sizes through M30	0.30–0.48	0.28–0.50
For size M36	0.35–0.53	0.33–0.55
Phosphorus, max	0.040	0.045
Sulfur, max	0.040	0.045
Alloying Elements	→ See 6.1 ←	

TABLE 2 Chemical Requirements for Type 3 Bolts

Element	Heat Analysis, %	Product Analysis, %
Carbon		
Sizes M20 and smaller	0.20–0.53	0.19–0.55
Sizes larger than M20	0.30–0.53	0.28–0.55
Manganese, min	0.40	0.37
Phosphorus, max	0.035	0.040
Sulfur, max	0.040	0.045
Copper	0.20–0.60	0.17–0.63
Chromium, min	0.45	0.42
Nickel, min	0.20	0.17
or		
Molybdenum, min	0.15	0.14

Resistance of Low-Alloy Steels

2.2 ASME Standards:⁴

B1.13M Metric Screw Threads

B18.2.3.7M Metric Heavy Hex Structural Bolts

B18.24.1 Part Identifying Number (PIN) Code System

2.3 ISO Standards:⁴

7412 Hexagon Bolts for High Strength Structural

Bolting With Large Width Across Flats (Short Thread Length)—Product Grade C—Property Classes 8.8 and 10.9

2.4 SAE Standards:⁵

J121 Decarburization in Hardened and Tempered Threaded Fasteners

3. Terminology

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

4. Ordering Information

4.1 Orders for bolts under this specification shall include the following (see Note 1):

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

4.1.2 Size, including nominal bolt diameter, thread pitch, and bolt length;

4.1.3 Name of product: metric heavy hex structural bolts;

4.1.4 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;

4.1.5 ASTM designation and year of issue;

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

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.

4.1.7 Certification, if required (see Section 16); and

4.1.8 Special requirements, if required.

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

NOTE 1—A typical ordering description follows: 1000 pieces M24 × 3 × 100 mm long, heavy hex structural bolt, Type 1, ASTM A 490M–03; each with two hardened washers, ASTM F 436M, Type 1; and one heavy hex nut, ASTM A 563M, Grade DH.

4.2 Recommended Nuts

4.2.1 Nuts conforming to the requirements of Specification A 563M are the recommended nuts for use with Specification A 490M 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 563M—10S, 10S3, plain (uncoated)
3, weathering steel	A 563M—10S3, weathering steel

4.3 Recommended Washers

4.3.1 Washers conforming to Specification F 436M are the recommended washers for use with Specification F 490M 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

4.4 Other Accessories

4.4.1 When compressible washer type tension indicators are specified to be used with these bolts, they shall conform to Specification F 959M, Type 10.9.

5. Materials and Manufacture

5.1 *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 425°C.

5.2 *Threading*—The threads shall be cut or rolled.

5.3 *Protective Coatings*—The bolts shall not be coated⁶ by hot-dip zinc coating, mechanical deposition, or electroplating with zinc or other metallic coatings.

6. Chemical Composition

6.1 Type 1 bolts shall be alloy steel conforming to the chemical composition requirements in Table 1. The steel shall contain sufficient alloying elements to qualify it as an alloy steel (see Note 2).

NOTE 2—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.

⁶ 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.