
Standard Specification for

High-Strength Bolts for Structural Steel Joints [Metric]



AASHTO Designation: M 164M-06

ASTM Designation: A 325M-04b

AASHTO M 164M-06 is identical to ASTM A 325M-04b except for the following provisions:

1. All references to the ASTM standards contained in ASTM A 325M-04b, listed in the following table, shall be replaced with the corresponding AASHTO standard:

<i>Referenced Standards</i>	
ASTM	AASHTO
A 325M/A 325	M 164M, M 164
A 490	M 253
A 563M	M 291M
A 709/A 709M	M 270M/M 270
F 436M	M 293M

2. In Section 13.1 of ASTM A 325M-04b, change the phrase “furnish the test reports” to “furnish certified test reports”.
3. Replace Section 14.1 of ASTM A 325M-04b with the following:
14.1 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 meet all of its requirements.



Designation: A 325M – 04b

METRIC

Standard Specification for Structural Bolts, Steel, Heat Treated 830 MPa Minimum Tensile Strength [Metric]¹

This standard is issued under the fixed designation A 325M; 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 reappraisal. A superscript epsilon (ε) indicates an editorial change since the last revision or reappraisal.

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

1. Scope*

1.1 This specification² covers two types of quenched and tempered, steel, metric heavy hex structural bolts having a minimum tensile strength of 830 MPa (Note 1).

1.2 The bolts are intended for use in structural connections. These connections are comparable to those covered under the requirements of the Specification for Structural Joints using ASTM 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.³

1.3 The bolts are furnished in sizes M12 to M136 inclusive. They are designated by type denoting chemical composition as follows:

1.3.1 *Type 1*—Medium-carbon, carbon boron, medium carbon alloy, or alloy boron steel.

1.3.2 *Type 2*—Withdrawn in 2003.

1.3.3 *Type 3*—Weathering Steel.

1.4 This specification is applicable to metric heavy hex, structural bolts only.

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

1.6 The following safety hazard caveat pertains only to the test methods portion, Section 10, 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 For ASME Boiler and Pressure Vessel Code applications, see related Specification SA-325M in Section II of that Code.

³ Available from American Institute of Steel Construction (AISC), One E. Wacker Dr., Suite 3100, Chicago, IL 60601-2001.

NOTE 1—This specification is the metric companion to the inch pound Specification A 325.

2. Referenced Documents

2.1 ASTM Standards:⁴

A 153/A 153M Specification for Zinc Coating (Hot Dip) on Iron and Steel Hardware

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

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

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

B 695 Specification of Coatings of Zinc Mechanically Deposited on Iron and Steel

D 3951 Practice for Commercial Packaging

F 436M Specification for Hardened Steel Washers [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 Resistance of Low-Alloy Steels

2.2 ASME Standards:

B 1.13M Metric Screw Threads⁵

⁴ 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.

⁵ Available from American Society of Mechanical Engineers (ASME), ASME International Headquarters, Three Park Ave., New York, NY 10016-5900.

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

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A 325M – 04b

B 18.2.3.7M Metric Heavy Hex Structural Bolts⁵

B 18.18.3M Inspection and Quality Assurance for Special Purpose Fasteners⁵

B 18.24.1 Part Identifying Number (PIN) Code System⁵

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.

3.1.3 Name of product, heavy hex structural bolts.

3.1.4 When bolts threaded full length are required, Supplementary Requirement S1 shall be specified.

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

3.1.6 ASTM designation and year of issue.

3.1.7 Other components such as nuts, washers, and compressible washer-type direct-tension indicators, if required.

3.1.8 *Zinc Coating*—Specify the zinc-coating process required, for example, hot-dip, mechanically deposited, or no preference (see 4.3).

3.1.9 *Other Finishes*—Specify other protective finish, if required.

3.1.10 Test reports, if required (see Section 13).

3.1.11 Supplementary or special requirements, if required.

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

NOTE 2—A typical ordering description follows: 1000 pieces, M24×3×100, heavy hex structural bolts, Type 1 ASTM A 325M - 03, each with one hardened washer and one heavy hex nut, mechanically deposited zinc coating (see 3.1.8 for any special requirements).

3.2 Recommended Nuts:

3.2.1 Nuts conforming to the requirements of Specification A 563M are the recommended nuts for use with A 325M metric 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 Specification
1, plain (noncoated)	A 563M—8S or 8S3, plain
1, zinc-coated	A 563M—10S, zinc-coated
3, plain	A 563M—8S3, plain

3.3 Recommended Washers:

3.3.1 Washers conforming to Specification F 436M are the recommended washers for use with Specification A 325M Metric 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)
1, zinc-coated	zinc-coated
3, plain	weathering steel, plain

3.4 Other Accessories:

3.4.1 When compressible washer type direct tension indicators are specified to be used with these bolts, they shall conform to the requirements in Specification F 959M Type 8.8.

4. Materials and Manufacture

4.1 Heat Treatment:

TABLE 1 Chemical Requirements for Type 1 Bolts

Element	Carbon Steel	
	Heat Analysis	Product Analysis
Carbon	0.30–0.52	0.28–0.55
Manganese, min	0.60	0.57
Phosphorus, max	0.040	0.048
Sulfur, max	0.050	0.058
Silicon	0.15–0.30	0.13–0.32

Element	Carbon Boron Steel	
	Heat Analysis	Product Analysis
Carbon	0.30–0.52	0.28–0.55
Manganese, min	0.60	0.57
Phosphorus, max	0.040	0.048
Sulfur, max	0.050	0.058
Silicon	0.10–0.30	0.08–0.32
Boron	0.0005–0.003	0.0005–0.003

Element	Alloy Steel	
	Heat Analysis	Product Analysis
Carbon	0.30–0.52	0.28–0.55
Manganese, min	0.60	0.57
Phosphorus, max	0.035	0.040
Sulfur, max	0.040	0.045
Silicon	0.15–0.35	0.13–0.37
Alloying Elements	A	A

	Alloy Boron Steel	
	Heat Analysis	Product Analysis
Carbon	0.30–0.52	0.28–0.55
Manganese, min	0.60	0.57
Phosphorus, max	0.035	0.040
Sulfur, max	0.040	0.045
Silicon	0.15–0.35	0.13–0.37
Boron	0.0005–0.003	0.0005–0.003
Alloying Elements	A	A

^A Steel, as defined by the American Iron and Steel Institute, shall be considered to be alloy 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.

4.1.1 Type 1 bolts produced from medium carbon steel shall be quenched in a liquid medium from the austenitizing temperature.

4.1.2 Type 1 bolts produced from carbon steel to which chromium, nickel, molybdenum, or boron were intentionally added shall be quenched only in oil from the austenitizing temperature.

4.1.3 Type 3 bolts shall be quenched only in oil from the austenitizing temperature.

4.1.4 Type 1 bolts, regardless of the steel used, and Type 3 bolts, shall be tempered by reheating to not less than 427°C.

4.2 *Threading*—Threads shall be cut or rolled.

4.3 *Zinc Coatings, Hot-dip and Mechanically Deposited:*

4.3.1 When zinc-coated fasteners are required, the purchaser shall specify the zinc coating process, for example, hot dip, mechanically deposited, or no preference.