



Standard Specification for High-Strength Bolts for Structural Steel Joints [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 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 specification² covers requirements of various types of quenched and tempered steel bolts in nominal thread diameters M16 to M36 inclusive, commonly known as “high-strength structural bolts,” intended for use in structural joints that are comparable to those made under the Specifications for Structural Joints Using ASTM A 325 or A 490 Bolts,³ issued by the Research Council on Structural Connections of the Engineering Foundation. Types of bolts covered in this specification are:

1.1.1 *Type 1*—Bolts made of medium-carbon steel.

1.1.2 *Type 2*—Bolts made from what is generally described as low-carbon martensite steel.

1.1.3 *Type 3*—Bolts made of steel having atmospheric corrosion resistance and weathering characteristics comparable to that of the steel covered in Specifications A 588/A 588M, A 242/A A 242M, and A 709/A 709M. The atmospheric corrosion resistance of these steels is substantially better than that of carbon steel with or without copper addition (see 5.3). When properly exposed to the atmosphere, these steels can be used bare (uncoated) for many applications.

1.2 This specification provides that heavy hex structural bolts shall be furnished unless other dimensional requirements are stipulated in the purchase inquiry and order.

1.3 Unless otherwise specified, all nuts used on these bolts shall conform to the requirements of Specification A 563M shall be heavy hex, and shall be of the class and surface finish for each type of bolt as follows:

Bolt Type and Finish	Nut Class and Finish
1 and 2, plain (noncoated)	8S or 8S3, plain
1 and 2, zinc-coated	10S, zinc-coated
3, plain	8S3, plain

1.4 Unless otherwise specified, all washers used on these bolts shall conform to the requirements of Specification

F 436M and shall be of a surface finish for each type of bolt as follows:

Bolt Type and Finish	Washer Finish
1 and 2, plain (uncoated)	plain (uncoated)
1 and 2, zinc-coated	zinc-coated
3, plain	weathering steel, plain

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

1.5 Zinc-coated bolts and nuts shall be shipped in the same container.

2. Referenced Documents

2.1 ASTM Standards:

A 242/A242M Specification for High-Strength Low-Alloy Structural Steel⁴

A 325 Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength⁵

A 490 Specification for Heat-Treated Steel Structural Bolts, 150 ksi Minimum Tensile Strength⁵

A 563M Specification for Carbon and Alloy Steel Nuts [Metric]⁵

A 588/A588M Specification for High-Strength Low-Alloy Structural Steel with 50 ksi [345 MPa] Minimum Yield Point to 4 in. [100 mm] Thick⁴

A 709/A709M Specification for Structural Steel for Bridges⁴

A 751 Test Methods, Practices, and Terminology for Chemical Analysis of Steel Products⁶

D 3951 Practice for Commercial Packaging⁷

F 436M Specification for Hardened Steel Washers [Metric]⁵

F 568 Specification for Carbon and Alloy Steel Externally Threaded Metric Fasteners⁵

F 606 Test Methods for Determining the Mechanical Properties of Externally and Internally Threaded Fasteners, Washers, and Rivets⁵

F 788/F788M Specification for Surface Discontinuities of Bolts, Screws, and Studs, Inch and Metric Series⁵

G 101 Guide for Estimating the Atmospheric Corrosion

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 Published by American Institute of Steel Construction, Wrigley Building, 400 N. Michigan Ave., Chicago, IL 60611.

⁴ Annual Book of ASTM Standards, Vol 01.04.

⁵ Annual Book of ASTM Standards, Vol 01.08.

⁶ Annual Book of ASTM Standards, Vol 01.03.

⁷ Annual Book of ASTM Standards, Vol 15.09.

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

 **A 325M**

Resistance of Low-Alloy Steels⁸

2.2 *ANSI/ASME Standards:*

B 1.13M Metric Screw Threads⁹

B 18.2.3.7M Metric Heavy Hex Structural Bolts⁹

B 18.2.4.6M Metric Heavy Hex Nuts⁹

B 18.24.1 Part Identifying Number (PIN) Code System¹⁰

2.3 *Military Standard:*¹¹

MIL-STD-105 Sampling Procedure and Tables for Inspection by Attributes

3. Ordering Information

3.1 Orders for products under this specification shall include the following:

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

3.1.2 Name of products, including accessories such as nuts and washers when desired.

3.1.3 *Zinc Coating*—Specify the zinc-coating process required, for example, hot-dip, mechanically deposited, or no preference (see 4.1).

3.1.4 *Other Finishes*—Specify other protective finish if required.

3.1.5 Dimensions including nominal bolt diameter, thread pitch, and length. For bolts of dimensional requirements other than heavy hex structural bolts (see 1.2), it is normally necessary to specify grip length.

3.1.6 Type of bolt (that is, Type 1, 2, or 3).

3.1.6.1 When the bolt type is not specified, either Type 1 or Type 2 may be supplied at the option of the manufacturer. Type 3 bolts may be supplied by the manufacturer if agreed upon by the purchaser.

3.1.6.2 Where elevated temperature applications are involved, Type 1 bolts shall be specified by the purchaser.

3.1.6.3 When atmospheric corrosion resistance is required, Type 3 bolts shall be specified by the purchaser.

3.1.6.4 When zinc-coated high-strength structural bolts are specified, the bolts shall be either Types 1 or 2, at the manufacturer's option, unless otherwise ordered by the purchaser.

3.1.7 ASTM designation and year of issue.

3.1.8 Any special requirements.

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

NOTE 2—Two examples of ordering descriptions follow: (1) 1000 pieces, heavy hex structural bolts, each with one hardened washer and one heavy hex nut, hot-dip zinc-coated, M 24 × 3 × 100, ASTM A 325M – XX. (2) 1000 pieces, heavy hex structural bolts, no nuts or washers, M 20 × 2.5 × 80 Type 3, ASTM A 325M – XX.

4. Materials and Manufacture

4.1 Steel for bolts, and the heading, threading, heat treatment and zinc-coating of bolts shall be in accordance with requirements specified for classes 8.8 and 8.8.3 bolts in Specification F 568.

⁸ *Annual Book of ASTM Standards*, Vol 03.02.

⁹ Available from American National Standards Institute, 11 West 42nd Street, 13th Floor, York, NY 10036.

¹⁰ Available from American Society of Mechanical Engineers, Three Park Avenue, New York, NY 10016-5990.

¹¹ Available from Standardization Documents Order Desk, Bldg. 4 Section D, 700 Robbins Ave., Philadelphia, PA 19111-5094, Attn: NPODS.

5. Chemical Composition

5.1 Type 1 bolts shall conform to the chemical composition requirements specified for medium carbon steel class 8.8 bolts in Specification F 568.

5.2 Type 2 bolts shall conform to the chemical composition requirements specified for low-carbon martensite steel class 8.8 bolts in Specification F 568.

5.3 Type 3 bolts shall conform to the chemical composition requirements specified for Class 8.8.3 bolts in Specification F 568. See Guide G 101 for methods of estimating the atmospheric corrosion resistance of low alloy steels.

5.4 Chemical analyses shall be performed in accordance with Test Methods A 751.

6. Mechanical Properties

6.1 Bolts shall meet the mechanical requirements specified for classes 8.8 and 8.8.3 bolts in Specification F 568. For information purposes only, the mechanical properties of bolts are given in Appendix X1.

6.2 In addition, when zinc-coated bolts and nuts are supplied, the bolt/nut assembly shall be tested full size in an assembled joint as specified in 9.2. After initial tightening, the nut shall be capable of being turned through the following rotation with respect to the bolt without producing bolt or nut failure:

Bolt Length ^A	Nut Rotation, °
Up to and incl 4D	300
Over 4D to 8D	360
Over 8D	420

^A D is nominal bolt diameter.

7. Dimensions

7.1 Bolts with hex heads shall be full-body bolts conforming to the dimensions for heavy hex structural bolts specified in ANSI B 18.2.3.7M.

7.2 Threads shall be Metric Coarse Thread Series as specified in ANSI B 1.13M, and shall have grade 6g tolerances.

7.3 Unless otherwise specified, zinc-coated bolts, to be used with zinc-coated nuts which have been tapped oversize in accordance with Specification A 563M shall have grade 6g threads before hot dip or mechanically deposited zinc-coating. After zinc-coating the maximum limits of pitch diameter and major diameter may exceed grade 6g limits by the following amount:

Nominal Bolt Diameter	Oversize Limit, mm
M16	0.42
M20	0.53
M22	0.53
M24	0.64
M27	0.64
M30	0.75
M36	0.86

7.4 The acceptability of assemblage of zinc-coated bolts shall be verified during manufacture or use by assembly with a nut tapped as nearly as practical to the oversize limit shown above. In case of dispute, a calibrated thread ring gage of that same size (Class X tolerance, gage tolerance plus) shall be used. Assembly of the gage, or the nut described above, shall be possible with hand effort following application of light machine oil to prevent galling and damage to the gage. These inspections, when performed to resolve disputes, shall be