Designation: A 563M – 07

METRIC

Standard Specification for Carbon and Alloy Steel Nuts [Metric][1]

This standard is issued under the fixed designation A 563M; 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 chemical and mechanical requirements for eight property classes of hex and hex-flange carbon and alloy steel nuts for general structural and mechanical uses on bolts, studs, and other externally threaded parts.

NOTE 1—Throughout this specification, the term class means property class.

NOTE 2—Requirements for the four classes 5, 9, 10, and 12 are essentially identical with requirements given for these classes in ISO 898/II. Requirements for Classes 8S and 10S are essentially identical with requirements in an ISO 4775 Hexagon Nuts for High-Strength Structural Bolting with Large Width Across Flats, Product Grade B, Property Classes 8 and 10. Classes 8S3 and 10S3 are not recognized in ISO standards.

1.2 Classes 8S3 and 10S3 nuts have atmospheric corrosion resistance and weathering characteristics comparable to those of the steels covered in Specification A 588/A 588M. The atmospheric corrosion resistance of these steels is substantially better than that of carbon steel with or without copper addition (see 5.2). When properly exposed to the atmosphere, these steels can be used bare (uncoated) for many applications.

1.3 The nut size range for which each class is applicable is given in the table on mechanical requirements.

1.4 Appendix X1 gives guidance to assist designers and purchasers in the selection of a suitable class.

1.5 Appendix X2 gives data on the properties of slotted hex nuts and hex jam nuts.

NOTE 3—This specification is the metric companion of Specification A 563.

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

2. Referenced Documents

2.1 *ASTM Standards:* [2]

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

A 325M Specification for Structural Bolts, Steel, Heat Treated 830 MPa Minimum Tensile Strength [Metric]

A 394 Specification for Steel Transmission Tower Bolts, Zinc-Coated and Bare

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

A 588/A 588M Specification for High-Strength Low-Alloy Structural Steel, up to 50 ksi [345 MPa] Minimum Yield Point, with Atmospheric Corrosion Resistance

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

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

D 3951 Practice for Commercial Packaging

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

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

F 812/F 812M Specification for Surface Discontinuities of Nuts, Inch and Metric Series

F 1789 Terminology for F16 Mechanical Fasteners

G 101 Guide for Estimating the Atmospheric Corrosion Resistance of Low-Alloy Steels

2.2 *ANSI Standards:*[3]

B 1.13M Metric Screw Threads—M Profile

[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.

Current edition approved Dec. 1, 2007. Published January 2008. Originally approved in 1980. Last previous edition approved in 2006 as A 563M – 06.

[2] 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.

[3] Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, http://www.ansi.org.

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

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B 18.2.4.1M Metric Hex Nuts, Style 1
B 18.2.4.2M Metric Hex Nuts, Style 2
B 18.2.4.3M Metric Slotted Hex Nuts
B 18.2.4.4M Metric Hex Flange Nuts
B 18.2.4.5M Metric Hex Jam Nuts
B 18.2.4.6M Metric Heavy Hex Nuts

2.3 *ISO Standards:*[3]

ISO 898/II Mechanical Properties of Fasteners, Part II, Nuts With Specified Proof Loads
ISO 4775 Hexagon Nuts for High-Strength Structural Bolting with Large Width Across Flats—Product Grade B—Property Classes 8 and 10

3. Ordering Information

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

3.1.1 Quantity (number of nuts);

3.1.2 Nominal diameter and thread pitch;

3.1.3 Dimensional style of nut (for example, hex, heavy hex, or hex flange);

3.1.4 Property class of nut;

3.1.5 *Zinc Coating*—Specify the zinc coating process required, hot-dip, mechanically deposited, or no preference (see 4.7);

3.1.6 *Other Finishes*—Specify other protective finish if required;

3.1.7 ASTM designation and year of issue; and

3.1.8 Supplementary or special requirements.

3.2 The strength requirements for any class of nut may be satisfied by substituting a nut of a higher class provided that the nut width across flats is the same. With the written approval of the purchaser, the supplier may substitute as follows: Class 12 nuts for Classes 10, 9, and 5; Class 10 nuts for Classes 9 and 5; Class 9 nuts for Class 5; Class 10S for Class 8S; Class 8S3 for Class 8S; and Class 10S3 for Classes 10S, 8S, and 8S3.

NOTE 4—Purchasers are cautioned that different classes of nuts have different nut thickness (see 7.2 through 7.5). Dimensional suitability of the nut for the intended application should be considered before approving substitution of a higher class.

NOTE 5—Examples of ordering descriptions are: (*1*) 10 000 M12 × 1.75 hex nuts, Class 9, ASTM A 563M–XX; (*2*) 2500 M24 × 3 heavy hex nuts, Class 10S, hot-dip zinc-coated, ASTM A 563M–XX; and (*3*) 5000 M10 × 1.5 hex flange nuts, Class 10, ASTM A 563M–XX.

4. Materials and Manufacture

4.1 Steel for nuts shall be made by the open-hearth, basic-oxygen, or electric-furnace process.

4.2 Nuts may be made cold or hot by forming, pressing, or punching, or may be machined from bar stock.

4.3 Classes 10, 12, 10S, and 10S3 nuts shall be heat treated by quenching in a liquid medium from a temperature above the transformation temperature and tempering at a temperature of at least 425°C.

4.4 Classes 8S and 8S3 nuts made of any steel permitted for these classes may be heat treated by quenching in a liquid medium from a temperature above the transformation temperature and tempering at a temperature of at least 425°C.

4.5 Class 8S nuts made of steel having a carbon content not exceeding 0.20 %, phosphorus not exceeding 0.04 %, and sulfur not exceeding 0.05 % by heat analysis may be heat treated by quenching in a liquid medium from a temperature above the transformation temperature and need not be tempered. When this heat treatment is used, particular attention shall be paid to the requirements in 6.1.

4.6 Threads shall be formed, tapped, or machined.

4.7 *Zinc Coatings, Hot-Dip and Mechanically Deposited*:

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

4.7.2 When hot-dip is specified, the fasteners shall be zinc-coated by the hot-dip process in accordance with the requirements of Class C of Specification A 153/A 153M.

4.7.3 When mechanically deposited is specified, the fasteners shall be zinc-coated by the mechanical-deposition process in accordance with the requirements of Class 55 of Specification B 695.

4.7.4 When no preference is specified, the supplier may furnish either a hot-dip zinc coating in accordance with Specification A 153/A 153M, Class C, or a mechanically deposited zinc coating in accordance with Specification B 695, Class 55. All components of mating fasteners (bolts, nuts, and washers) shall be coated by the same zinc coating process and the supplier's option is limited to one process per item with no mixed processes in a lot.

4.7.5 Hot-dip zinc coated nuts shall be tapped after zinc coating in accordance with the thread limits in 7.8.

4.7.6 Mechanically deposited zinc-coated nuts for assembly with mechanically deposited zinc-coated bolts shall be tapped oversize in accordance with the thread limits in 7.8 prior to zinc coating and need not be retapped afterwards.

NOTE 6—It is the intent of 4.7 and 4.8 together with the requirements specified in 7.8 that galvanized bolts and nuts will assemble freely, regardless of source of supply.

4.8 Hot-dip and mechanically deposited zinc-coated Class 10S nuts shall be provided with an additional lubricant that shall be clean and dry to the touch.

5. Chemical Composition

5.1 Classes 5, 9, 8S, 10, 10S, and 12 shall conform to the chemical composition specified in Table 1.

5.2 Classes 8S3 and 10S3 shall conform to the chemical composition specified in Table 2. See Guide G 101 for methods of estimating corrosion resistance of low alloy steels.

5.3 Resulfurized or rephosphorized steel, or both, are not subject to rejection based on product analysis for sulfur or phosphorus unless misapplication is clearly indicated.

5.4 Application of heats of steel to which bismuth, selenium, tellurium, or lead has been intentionally added shall not be permitted for Classes 10, 12, 10S, and 10S3.

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

6. Mechanical Properties

6.1 The hardness of nuts of each class shall not exceed the maximum hardness specified for the class in Table 3. This shall be the only hardness requirement for nuts that are proof load tested.

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TABLE 1 Chemical Requirements

Property Class of Nut	Composition, %				
	Analysis	Carbon	Manganese, min	Phosphorus, max	Sulfur, max
5, 9, 8S	heat	0.55 max	. . .	0.04	0.15[A]
	product	0.58 max	. . .	0.048	. . .
10[B], 10S	heat	0.55 max	0.30	0.04	0.05
	product	0.58 max	0.27	0.048	0.058
12[B]	heat	0.20–0.55	0.60	0.04	0.05
	product	0.18–0.58	0.57	0.048	0.058
8S3, 10S3	See Table 2				

[A] For Classes 5 and 9, a sulfur content of 0.23 % max. is acceptable with the purchasers approval.
[B] For Classes 10 and 12, a sulfur content of 0.15 % max. is acceptable provided the manganese is 1.35 % min.

6.2 Unless proof load testing is specified in the inquiry and purchase order, nuts of all classes in nominal thread diameters M4 and smaller, and nuts of all classes with proof loads greater than 530 kN, as specified in Table 4, may be furnished on the basis of having a hardness not less than the minimum hardness specified in Table 3.

6.3 Nuts of all classes, except those covered in 6.2, shall withstand the proof load stress specified for the diameter and class of nut in Table 3.

NOTE 7—The proof load of a nut is the axially applied load the nut must withstand without thread stripping or rupture. Proof loads (Table 4) are computed by multiplying proof load stress (Table 3) by the nut thread stress area.

7. Dimensions

7.1 Unless otherwise specified, nuts shall be furnished plain (non-coated nor plated).

7.2 Class 5 nuts in nominal thread diameters M36 and smaller shall conform to dimensions for hex nuts, Style 1, given in ANSI B 18.2.4.1M. Class 5 nuts in nominal thread diameters M42 and larger shall conform to dimensions for heavy hex nuts given in ANSI B 18.2.4.6M.

7.3 Class 9 nuts in nominal thread diameters M20 and smaller shall conform to dimensions for hex nuts, Style 2, given in ANSI B 18.2.4.2M or for hex flange nuts given in ANSI B 18.2.4.4M. When the dimensional style of nut is not designated by the purchaser, hex nuts, Style 2, in conformance with ANSI B 18.2.4.2M shall be furnished. Class 9 nuts in nominal thread diameters M24 to M36 inclusive shall conform to dimensions for hex nuts, Style 2, given in ANSI B 18.2.4.2M. Class 9 nuts in nominal thread diameters M42 and larger shall conform to dimensions for heavy hex nuts given in ANSI B 18.2.4.6M.

7.4 Class 10 nuts in nominal thread diameters M20 and smaller shall conform to dimensions for hex nuts, Style 1, given in ANSI B 18.2.4.1M or for hex flange nuts given in ANSI B 18.2.4.4M. When the dimensional style of nut is not designated by the purchaser, hex nuts, Style 1, in conformance with ANSI B 18.2.4.1M shall be furnished. Class 10 nuts in nominal thread diameters from M24 to M36 inclusive shall conform to dimensions for hex nuts, Style 1 given in ANSI B 18.2.4.1M.

7.5 Class 12 nuts in nominal thread diameters M20 and smaller shall conform to dimensions for hex nuts, Style 2, given in ANSI B 18.2.4.2M or for hex flange nuts given in ANSI B 18.2.4.4M. When the dimensional style of the nut is not designated by the purchaser, hex nuts, Style 2, in conformance with ANSI B 18.2.4.2M shall be furnished. Class 12 nuts in nominal thread diameters M24 to M36 inclusive shall conform to dimensions for hex nuts, Style 2, given in ANSI B 18.2.4.2M. Class 12 nuts in nominal thread diameters M42 and larger shall conform to dimensions for heavy hex nuts given in ANSI B 18.2.4.6M.

7.6 Classes 8S, 8S3, 10S, and 10S3 in nominal thread diameters M12 to M36 inclusive shall conform to dimensions for heavy hex nuts given in ANSI B 18.2.4.6M.

7.7 Unless otherwise specified, threads in nuts shall be the metric coarse thread series as specified in ANSI B 1.13M, and shall have grade 6H tolerances.

7.8 This requirement applies to nuts hot-dip and mechanically zinc-coated that are to be used on bolts, screws, or studs that have metric coarse threads with Grade 6G tolerances before zinc-coating and then are hot-dip or mechanically zinc-coated, except as noted in 7.9, in accordance with 4.7.2 and 4.7.3. Such nuts shall be tapped oversize to have internal threads with maximum and minimum limits that exceed the maximum and minimum limits specified for metric coarse internal threads with Grade 6H tolerances by the following diametral allowances:

Nut Diameter	Diametral Allowance, µm
M5	156
M6	200
M8	255
M10	310
M12	365
M14 and M16	420
M20 and M22	530
M24 and M27	640
M30	750
M36	860
M42	970
M48	1080
M56	1190
M64 to M100	1300

NOTE 8—Bolts, screws, and studs in diameters smaller than M10 are not normally hot-dip zinc-coated.

7.8.1 Internal threads shall be subject to acceptance gaging using GO and HI thread plug gages having size limits as established in 7.8. Threads of nuts tapped after zinc coating (4.7) shall meet GO and HI thread plug gaging requirements as tapped. Threads of nuts tapped prior to zinc coating (4.8) shall meet HI thread plug gaging requirements prior to zinc coating and GO thread plug gaging requirements after zinc coating.

7.9 Nuts to be used on bolts, screws, or studs that are hot-dip or mechanically zinc-coated to requirements other than specified in 7.8 shall be tapped oversize by a diametral allowance sufficient to permit assembly on the coated externally threaded fastener.

NOTE 9—If the over-tapping diametral allowance is greater than the limit specified in 7.8, the purchaser is cautioned that the nut may not meet the proof load stress specified in Table 3.

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TABLE 2 Chemical Requirements for Classes 8S3 and 10S3 Nuts

Element	Composition, %							
	Steel Analyses for Class 8S3 Nuts[A]							Class 10S3 Nuts
	N	A	B	C	D	E	F	
Carbon:								
Heat analysis	. . .	0.33–0.40	0.38–0.48	0.15–0.25	0.15–0.25	0.20–0.25	0.20–0.25	0.20–0.53
Product analysis	. . .	0.31–0.42	0.36–0.50	0.14–0.26	0.14–0.26	0.18–0.27	0.19–0.26	0.19–0.55
Manganese:								
Heat analysis	. . .	0.90–1.20	0.70–0.90	0.80–1.35	0.40–1.20	0.60–1.00	0.90–1.20	0.40 min
Product analysis	. . .	0.86–1.24	0.67–0.93	0.76–1.39	0.36–1.24	0.56–1.04	0.86–1.24	0.37 min
Phosphorus:								
Heat analysis	0.07–0.15	0.040 max	0.06–0.12	0.035 max	0.040 max	0.040 max	0.040 max	0.046 max
Product analysis	0.07–0.155	0.045 max	0.06–0.125	0.040 max	0.045 max	0.045 max	0.045 max	0.052 max
Sulfur:								
Heat analysis	0.050 max	0.050 max	0.050 max	0.040 max	0.050 max	0.040 max	0.040 max	0.050 max
Product analysis	0.055 max	0.055 max	0.055 max	0.045 max	0.055 max	0.045 max	0.045 max	0.055 max
Silicon:								
Heat analysis	0.20–0.90	0.15–0.35	0.30–0.50	0.15–0.35	0.25–0.50	0.15–0.35	0.15–0.35	. . .
Product analysis	0.15–0.95	0.13–0.37	0.25–0.55	0.13–0.37	0.20–0.55	0.13–0.37	0.13–0.37	. . .
Copper:								
Heat analysis	0.25–0.55	0.25–0.45	0.20–0.40	0.20–0.50	0.30–0.50	0.30–0.60	0.20–0.40	0.20 min
Product analysis	0.22–0.58	0.22–0.48	0.17–0.43	0.17–0.53	0.27–0.53	0.27–0.63	0.17–0.43	0.17 min
Nickel:								
Heat analysis	1.00 max	0.25–0.45	0.50–0.80	0.25–0.50	0.50–0.80	0.30–0.60	0.20–0.40	0.20 min[B]
Product analysis	1.03 max	0.22–0.48	0.47–0.83	0.22–0.53	0.47–0.83	0.27–0.63	0.17–0.43	0.17 min
Chromium:								
Heat analysis	0.30–1.25	0.45–0.65	0.50–0.75	0.30–0.50	0.50–1.00	0.60–0.90	0.45–0.65	0.30 min
Product analysis	0.25–1.30	0.42–0.68	0.47–0.83	0.27–0.53	0.45–1.05	0.55–0.95	0.42–0.68	0.25 min
Vanadium:								
Heat analysis	. . .	. . .	. . .	0.020 min	. . .	. . .	. . .	. . .
Product analysis	. . .	. . .	. . .	0.010 min	. . .	. . .	. . .	. . .
Molybdenum:								
Heat analysis	. . .	. . .	0.06 max	. . .	0.10 max	. . .	. . .	0.15 min[B]
Product analysis	. . .	. . .	0.07 max	. . .	0.11 max	. . .	. . .	0.14 min
Titanium:								
Heat analysis	. . .	. . .	. . .	. . .	0.05 max	. . .	. . .	. . .
Product analysis	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .

[A] Class 8S3 nuts may be made of any of the listed steel analyses. Selection of steel analysis shall be the option of the manufacturer.
[B] Nickel or molybdenum may be used.

7.10 When specifically permitted by the purchaser, nuts for bolts, screws, or studs having an electrodeposited coating, such as cadmium, zinc, etc., or having a chemically applied coating may be tapped oversize by a diametral allowance sufficient to permit assembly on the coated externally threaded fastener.

NOTE 10—If the overtapping diametral allowance is greater than the limit specified in 7.8, the purchaser is cautioned that the nut may not meet the proof load stress specified in Table 3.

8. Workmanship

8.1 Surface discontinuity limits shall be in accordance with Specification F 812/F 812M.

9. Number of Tests

9.1 The requirements of this specification shall be met in continuous mass production for stock, and the manufacturer shall make sample inspections to ensure that the product conforms to the specified requirements (Section 15). Additional tests of individual shipments of material are not ordinarily contemplated. Individual heats of steel are not identified in the finished product.

9.2 When additional tests are specified in the inquiry and purchase order, a lot, for purposes of selecting test samples, shall consist of all nuts offered for inspection at one time that have the following common characteristics:

9.2.1 Property class,

9.2.2 Nominal diameter,

9.2.3 Style,

9.2.4 Thread series and tolerance grade, and

9.2.5 Surface finish.

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TABLE 3 Mechanical Requirements of Nuts

Nominal Diameter	Property Class 5					Property Class 5 (overtapped)					Property Class 9				
	Proof Load Stress, MPa	Hardness Rockwell min	Hardness Rockwell max	Hardness Vickers min	Hardness Vickers max	Proof Load Stress, MPa	Hardness Rockwell min	Hardness Rockwell max	Hardness Vickers min	Hardness Vickers max	Proof Load Stress, MPa	Hardness Rockwell min	Hardness Rockwell max	Hardness Vickers min	Hardness Vickers max
M1.6 to M2.5											...	...	...	...	...
M3 to M4	520	B70	C30	130	302	...	...	...	...	...	900	B85	C30	170	302
M5 and M6	580	B70	C30	130	302	465	B70	C30	130	302	915	B89	C30	188	302
M8 and M10	590	B70	C30	130	302	470	B70	C30	130	302	940	B89	C30	188	302
M12 to M16	610	B70	C30	130	302	490	B70	C30	130	302	950	B89	C30	188	302
M20 to M36	630	B78	C30	146	302	500	B78	C30	146	302	920	B89	C30	188	302
M42 to M100	630	B70	C30	128	302	500	B70	C30	128	302	920	B89	C30	188	302

Nominal Diameter	Property Class 10					Property Class 12					Property Class 12 (Overtapped)				
	Proof Load Stress, MPa	Hardness Rockwell min	Hardness Rockwell max	Hardness Vickers min	Hardness Vickers max	Proof Load Stress, MPa	Hardness Rockwell min	Hardness Rockwell max	Hardness Vickers min	Hardness Vickers max	Proof Load Stress, MPa	Hardness Rockwell min	Hardness Rockwell max	Hardness Vickers min	Hardness Vickers max
M1.6 to M2.5						...	...	...	...	...	...	...	...	...	
M3 to M4	1040	C26	C36	272	353	1150	C26	C36	272	353					
M5 and M6											920	C26	C36	272	353
M8 and M10						1160	C26	C36	272	353	930	C26	C36	272	353
M12 to M16	1050	C26	C36	272	353	1190	C26	C36	272	353	950	C26	C36	272	353
M20 to M36	1060	C26	C36	272	353	1200	C26	C36	272	353	960	C26	C36	272	353
M42 to M100	...	...	...	...	...	1200	C26	C36	272	353	960	C26	C36	272	353

Nominal Diameter	Property Class 8S and 8S3					Property Class 10S and 10S3					Property Class 10 S (Overtapped)				
	Proof Load Stress, MPa	Hardness Rockwell min	Hardness Rockwell max	Hardness Vickers min	Hardness Vickers max	Proof Load Stress, MPa	Hardness Rockwell min	Hardness Rockwell max	Hardness Vickers min	Hardness Vickers max	Proof Load Stress, MPa	Hardness Rockwell min	Hardness Rockwell max	Hardness Vickers min	Hardness Vickers max
M12 to M36	1075	B89	C38	188	372	1245	C26	C38	272	372	1165	C26	C38	272	372

9.3 Unless otherwise specified in the inquiry and purchase order, the number of tests for each lot of each required property shall be as follows:

Number of Nuts in Lot	Number of Specimens
800 and under	1
801 to 8000	2
8001 to 22 000	3
Over 22 000	5

10. Test Methods

10.1 Hardness and proof load tests of nuts shall be performed in accordance with requirements of Test Methods F 606M.

10.2 For nut proof load testing, the speed of testing as determined with a free-running cross head shall be a maximum of 25 mm/min.

11. Report

11.1 When specified in the order, the manufacturer shall furnish a test report certified to be the last completed set of mechanical tests for each stock size in each shipment.

12. Inspection

12.1 If the inspection described in 12.2 is required by the purchaser, it shall be specified in the inquiry and contract or order.

12.2 The inspector representing the purchaser shall have free entry to all parts of manufacturer's works that concern the manufacture of the material ordered. The manufacturer shall afford the inspector all reasonable facilities to satisfy him that the material is being furnished in accordance with this specification. All tests and inspection required by the specification that are requested by the purchaser's representative shall be made prior to shipment, and shall be conducted as not to interfere unnecessarily with the operation of the works.

13. Product Marking

13.1 Nuts in nominal thread diameters M4 and smaller need not be marked.

13.2 Nuts of all classes, in nominal thread diameters M5 and larger, shall be marked with the property class designation (5, 9, 10, 12, 8S, 10S, 8S3, or 10S3) on the top or bearing surface, on the top of flange, or on one of the wrenching flats of the nut. Markings located on the top or bearing surface or on the top of the flange shall be positioned with the base of the numeral(s) oriented toward the nut periphery. Class 9 nuts marked on one of the wrenching flats shall have the numeral 9 underlined.

13.3 Additionally, nuts of Classes 10, 12, 8S, 8S3, 10S, and 10S3 shall be marked with a symbol to identify the manufacturer or private label distributor, as appropriate. The manufacturer's identification symbol shall be of his design.

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TABLE 4 Nut Proof Load Values, kN

NOTE 1—Nuts of diameters and classes where no proof loads are given are non-standard.
NOTE 2— Proof loads are computed by multiplying proof load stress (Table 3) by thread stress area and dividing by 1000.

Nominal Diameter and Thread Pitch	Thread Stress Area, mm²	Property Class of Nut								
		5	5 (over-tapped)	9	10	12	12 (over-tapped)	8S and 8S3	10S and 10S3	10S (over-tapped)
M1.6 x 0.35	1.27	0.66	. . .	. . .	1.32	. . .	. . .	. . .	. . .	. . .
M2 x 0.4	2.07	1.08	. . .	. . .	2.15	. . .	. . .	. . .	. . .	. . .
M2.5 x 0.45	3.39	1.76	. . .	. . .	3.53	. . .	. . .	. . .	... . ..	. . .
M3 x 0.5	5.03	2.62	. . .	4.53	5.23	. . .	. . .	. . .	. . .	. . .
M3.5 x 0.6	6.78	3.53	. . .	6.10	7.05	. . .	. . .	. . .	. . .	. . .
M4 x 0.7	8.78	4.57	. . .	7.90	9.13	. . .	. . .	. . .	. . .	. . .
M5 x 0.8	14.2	8.23	6.60	13.0	14.8	16.3	13.1	. . .	. . .	. . .
M6 x 1	20.1	11.7	9.35	18.4	20.9	23.1	18.5	. . .	. . .	. . .
M8 x 1.25	36.6	21.6	17.2	34.4	38.1	42.5	34.0	. . .	. . .	. . .
M10 x 1.5	58.0	34.2	27.3	54.5	60.3	67.3	53.9	. . .	. . .	. . .
M12 x 1.75	84.3	51.4	41.3	80.1	88.5	100	80.1	90.6	105	98.2
M14 x 2	115	70.2	56.4	109	121	137	109	124	143	134
M16 x 2	157	95.8	76.9	149	165	187	149	169	195	183
M20 x 2.5	245	154	123	225	260	294	235	263	305	285
M22 x 2.5	303	. . .	. . .	. . .	. . .	. . .	291	326	377	353
M24 x 3	353	222	177	325	374	424	339	379	439	411
M27 x 3	459	. . .	. . .	. . .	. . .	. . .	. . .	493	571	535
M30 x 3.5	561	353	281	516	595	673	539	603	698	654
M36 x 4	817	515	409	752	866	980	784	878	1020	952
M42 x 4.5	1120	706	560	1030	. . .	1340	1080	. . .	. . .	. . .
M48 x 5	1470	920	735	1350	. . .	1760	1410	. . .	. . .	. . .
M56 x 5.5	2030	1280	1020	1870	. . .	2440	1950	. . .	. . .	. . .
M64 x 6	2680	1690	1340	2470	. . .	3220	2570	. . .	. . .	. . .
M72 x 6	3460	2180	1730	3180	. . .	4150	3320	. . .	. . .	. . .
M80 x 6	4340	2730	2170	3990	. . .	5210	4170	. . .	. . .	. . .
M90 x 6	5590	3520	2800	5140	. . .	6710	5370	. . .	. . .	. . .
M100 x 6	6990	4400	3500	6430	. . .	8390	6710	. . .	. . .	. . .

13.4 For Classes 8S3 and 10S3 nuts, the manufacturer may add other distinguishing marks to indicate the nut is atmospheric corrosion resistant and of a weathering grade of steel.

13.5 Markings may be raised or depressed at the option of the manufacturer. However, if markings are located on the bearing surface or on one of the wrenching flats, they shall be depressed.

13.6 Property class and manufacturer's or private label distributor's identification shall be separate and distinct. The two identifications shall preferably be in different locations and, when on the same level, shall be separated by at least two spaces.

14. Packaging and Package Marking

14.1 *Packaging*:

14.1.1 Unless otherwise specified, packaging shall be in accordance with Practice D 3951.

14.1.2 When special packaging requirements are required, they shall be defined at the time of the inquiry and order.

14.2 *Package Marking*:

14.2.1 Each shipping unit shall include or be plainly marked with the following information:

14.2.1.1 ASTM designation and grade,

14.2.1.2 Size,

14.2.1.3 Name and brand or trademark of the manufacturer,

14.2.1.4 Number of pieces,

14.2.1.5 Purchase order number, and

14.2.1.6 Country of origin.

15. Responsibility

15.1 The party responsible for the fastener shall be the organization that supplies the fastener to the purchaser.

16. Keywords

16.1 alloy steel; carbon steel; metric; nuts; steel; weathering steel

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SUPPLEMENTARY REQUIREMENTS

S1. Supplementary Lubricant Requirements for Nuts

S1.1 Nuts, regardless of specified finish, shall be provided with an additional lubricant that shall be clean and dry to the touch.

S2. Lubricant Dye

S2.1 In addition to the requirements of Supplementary Requirement S1, the lubricant shall have a contrasting color so that its presence is visually obvious.

S3. Lubricant Placement

S3.1 The lubricant shall be applied to specified surfaces on the nuts, such as (*1*) principally only those portions that are threaded, or (*2*) on threaded portions and either only one bearing surface or both bearing faces, as required, or (*3*) such other specific lubricant placement criteria as are agreed to between the purchaser and the user.

APPENDIXES

(Nonmandatory Information)

X1. INTENDED APPLICATION

X1.1 Table X1.1 presents guidance on the strength suitability of nuts for use in combination with various property classes of metric bolts, screws and studs.

X1.2 Various nut styles (H1, H2, HH, and HF) have different dimensions (width across flats, thickness, flange diameter). Purchasers are cautioned to consider the dimensional requirements of the application when selecting the most appropriate nut.

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TABLE X1.1 Nut/Bolt Suitability Guide

Class of Bolt,[A] Screw, or Stud	Nominal Diameter of Bolt/Nut Combination	Surface Finish of Bolt[B]	Property Class and Dimensional Style of Nut													
			5			9		10			12			8S	8S3	10S	10S3
			H1[C]	HH[D]	H2[E]	HF[F]	HH[D]	H1[C]	HF[F]	H2[E]	HF[F]	HH[D]	HH[D]	HH[D]	HH[D]	HH[D]	HH[D]
F 568, Class 4.6	M5 to M36	plain	G	H	I	I	H	I	I	I	I	I	I	I	I	I	I
		zinc-coated	G	H	H	H	H	H	H	I	I	H	H	H	I	H	
	M42 to M100	plain	H	G	H	H	I	H	H	H	H	I	H	H	H	H	
		zinc-coated	H	G	H	H	H	H	H	H	H	I	H	H	H	H	
F 568, Class 4.8	M1.6 to M16	plain	G	H	I	I	H	I	I	I	I	H	H	H	H	H	
		zinc-coated	G	H	H	H	H	H	H	I	I	H	H	H	I	H	
F 568, Class 5.8	M5 to M24	plain	G	H	I	I	H	I	I	I	I	H	I	I	I	I	
		zinc-coated	G	H	H	H	H	H	H	I	I	H	H	H	I	H	
F 568, Class 8.8	M16 to M36	plain	H	H	G	I	H	I	I	I	I	H	I	I	I	I	
		zinc-coated	H	H	H	H	H	H	H	G	I	H	H	H	I	H	
	M42 to M100	plain	H	H	H	H	G	H	H	H	H	I	H	H	H	H	
		zinc-coated	H	H	H	H	H	H	H	H	H	G	H	H	H	H	
F 568, Class 8.8.3	M16 to M36	plain	H	H	H	H	H	H	H	H	H	H	H	G	H	I	
F 568, Class 9.8	M1.6 to M16	plain	H	H	G	I	H	I	I	I	I	H	H	H	H	H	
		zinc-coated	H	H	H	H	H	H	H	G	I	H	H	H	I	H	
F 568, Class 10.9	M5 to M36	plain	H	H	H	H	H	G	I	I	I	H	I	I	I	I	
	M42 to M100		H	H	H	H	H	H	H	H	H	G	H	H	H	H	
F 568, Class 10.9.3	M16 to M36	plain	H	H	H	H	H	H	H	H	H	H	H	H	H	G	
F 568, Class 12.9	M1.6 to M36	plain	H	H	H	H	H	H	H	G	I	H	H	H	I	I	
	M42 to M100		H	H	H	H	H	H	H	H	H	G	H	H	H	H	
A 325M, Types 1 and 2	M16 to M36	plain	H	H	H	H	H	H	H	H	H	H	G	I	I	I	
		zinc-coated	H	H	H	H	H	H	H	H	H	H	H	H	G	H	
A 325M, Type 3	M16 to M36	plain	H	H	H	H	H	H	H	H	H	H	H	G	H	I	
A 490M, Types 1 and 2	M16 to M36	plain	H	H	H	H	H	H	H	H	H	H	H	H	G	I	
A 490M, Type 3	M16 to M36	plain	H	H	H	H	H	H	H	H	H	H	H	H	H	G	
A 394, Grade A	M12 to M24	zinc-coated	G	H	H	H	H	H	H	I	I	H	H	H	I	H	
A 394, Grade B	M12 to M24	zinc-coated	H	H	H	H	H	H	H	G	I	H	H	H	I	H	

[A] The term "bolt" includes all types of externally threaded products.
[B] "Plain" applies to any bolt that is non-coated or non-plated, or that has a coating or plating of insufficient thickness to require that the nut be overtapped. "Zinc-coated" applies to any bolt that is hot-dip or mechanically zinc-coated or otherwise coated or plated with a coating or plating of sufficient thickness to require the use of overtapped nuts.
[C] H1—ANSI B 18.2.4.1M hex nut, Style 1.
[D] HH—ANSI B 18.2.4.6M heavy hex nut.
[E] H2—ANSI B 18.2.4.2M hex nut, Style 2.
[F] HF—ANSI B 18.2.4.4M hex flange nut.
[G] Recommended nut class and style.
[H] Non-suitable nut.
[I] Suitable nut class and style.

X2. SLOTTED HEX NUTS AND HEX JAM NUTS

X2.1 *Slotted Hex Nuts:*

X2.1.1 Slotted hex nuts are available in nominal thread diameters M5 to M36 inclusive, and in Property Classes 5 and 10.

X2.1.2 Class 5 nuts are made of carbon steel conforming to chemical composition requirements given in Table 1. Class 10 nuts are made of carbon or alloy steel conforming to chemical composition requirements given in Table 1, and are heat treated as specified in 4.3.

X2.1.3 Classes 5 and 10 nuts have hardnesses as specified in Table 3, and proof load stresses equal to 80 % of the values specified in Table 3 for Classes 5 and 10, respectively. Slotted hex nuts are not normally proof load tested.

X2.1.4 Slotted hex nuts conform to dimensions given in ANSI B 18.2.4.3M.

X2.2 *Hex Jam Nuts:*

X2.2.1 Hex jam nuts are available in nominal thread diameters M5 to M36 inclusive, and in Property Classes 04 and 05.

X2.2.2 Class 04 nuts are made of carbon steel conforming to the chemical composition requirements specified for Class 9 nuts in Table 1. Class 05 nuts are made of carbon or alloy steel conforming to the chemical composition requirements specified for Class 10 nuts in Table 1, and are heat treated as specified in 4.3.

X2.2.3 Class 04 nuts have a proof load stress of 380 MPa, and a hardness of HV 188/302 for all diameters. Class 05 nuts have a proof load stress of 500 MPa, and a hardness of HV 272/353 for all diameters. Hex jam nuts are not normally proof load tested.

X2.2.4 Hex jam nuts conform to dimensions given in ANSI B 18.2.4.5M.

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SUMMARY OF CHANGES

Committee F16 has identified the location of selected changes to this standard since the last issue (A 563M-06) that may impact the use of this standard. (Approved Dec. 1, 2007.)

(*1*) Sections 4.7.3 and 4.7.4 were revised.

Committee F16 has identified the location of selected changes to this standard since the last issue, A 563M – 04, that may impact the use of this standard. (Approved June 1, 2006.)

(*1*) Revised 3.1.8.

(*2*) Added Supplementary Requirements section.

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