Designation: A 563 – 07a

Standard Specification for Carbons and Alloy Steel Nuts[1]

This standard is issued under the fixed designation A 563; 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[2] covers chemical and mechanical requirements for eight grades of carbon and alloy steel nuts for general structural and mechanical uses on bolts, studs, and other externally threaded parts.

NOTE 1—See Appendix X1 for guidance on suitable application of nut grades.

1.2 The requirements for any grade of nut may, at the supplier's option, and with notice to the purchaser, be fulfilled by furnishing nuts of one of the stronger grades specified herein unless such substitution is barred in the inquiry and purchase order.

1.3 Grades C3 and DH3 nuts have atmospheric corrosion resistance and weathering characteristics comparable to that of the steels covered in Specifications A 242/A 242M, A 588/A 588M, 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 5.2). When properly exposed to the atmosphere, these steels can be used bare (uncoated) for many applications.

NOTE 2—A complete metric companion to Specification A 563 has been developed—A 563M; therefore, no metric equivalents are presented in this specification.

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

2. Referenced Documents

2.1 *ASTM Standards:* [3]

A 194/A 194M Specification for Carbon and Alloy Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both

A 242/A 242M Specification for High-Strength Low-Alloy Structural Steel

A 307 Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength

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

A 449 Specification for Hex Cap Screws, Bolts and Studs, Steel, Heat Treated, 120/105/90 ksi Minimum Tensile Strength, General Use

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

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 687 Specification for High-Strength Nonheaded Steel Bolts and Studs[4]

A 709/A 709M Specification for Structural Steel for Bridges

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 606 Test Methods for Determining the Mechanical Properties of Externally and Internally Threaded Fasteners, Washers, Direct Tension Indicators, and Rivets

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

F 1789 Terminology for F16 Mechanical Fasteners

F 2329 Specification for Zinc Coating, Hot-Dip, Requirements for Application to Carbon and Alloy Steel Bolts, Screws, Washers, Nuts, and Special Threaded Fasteners

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

2.2 *ANSI Standards:*

[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 1966. Last previous edition approved in 2007 as A 563 – 07.

[2] For *ASME Boiler and Pressure Vessel Code* applications see related Specification SA – 563 in Section II of that Code.

[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.

[4] Withdrawn.

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

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ANSI B1.1 Unified Screw Threads[5]
ANSI B18.2.2 Square and Hex Nuts[5]

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 size and thread series of nuts,

3.1.3 Style of nut (for example, heavy hex),

3.1.4 Grade of nut,

3.1.5 *Zinc Coating*—Specify the zinc-coating process required, for example, 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.

NOTE 3—An example of an ordering description follows: 1000 7/8-9 heavy hex nuts, Grade DH, hot-dip zinc-coated, and lubricated, ASTM A 563–XX.

4. Materials and Manufacture

4.1 Steel for nuts shall be made by the open-hearth, basic-oxygen, or electric-furnace process except that steel for Grades O, A, and B nuts may be made by the acid-bessemer process.

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

4.3 Grades DH and DH3 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 800°F.

4.4 Grades C and D nuts made of steel having 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, there shall be particular attention to the requirements in 6.1.1.

4.5 Grades C, C3, and D nuts made of any steel permitted for these grades 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 800°F.

4.6 Threads shall be formed by tapping or machining.

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 Specification F 2329.

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 F 2329, or a mechanically deposited zinc coating in accordance with Specification B 695, Class 55. Threaded components (bolts and nuts) 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.

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

4.8 *Lubricant*:

4.8.1 Hot-dip and mechanically deposited zinc-coated Grade DH nuts shall be provided with an additional lubricant which shall be clean and dry to the touch (see Supplementary Requirement S1 to specify lubrication requirements for plain finish nuts).

4.8.2 See Supplementary Requirement S2 for option to specify a dye in the lubricant.

5. Chemical Composition

5.1 Grades O, A, B, C, D, and DH shall conform to the chemical composition specified in Table 1.

5.2 Grades C3 and DH3 shall conform to the chemical composition specified in Table 2. See Guide G 101 for methods of estimating the atmospheric 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.

5.4 Application of heats of steel to which bismuth, selenium, tellurium, or lead has been intentionally added shall not be permitted for Grades D, DH, and DH3.

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

6. Mechanical Properties

6.1 *Hardness*:

6.1.1 The hardness of nuts of each grade shall not exceed the maximum hardness specified for the grade in Table 3.

TABLE 1 Chemical Requirements for Grades O, A, B, C, D, and DH Nuts

Grade of Nut	Composition, %				
	Analysis	Carbon	Manganese, min	Phosphorus, max	Sulfur, max
O, A, B, C	heat	0.55 max	...	0.12	0.15[A]
	product	0.58 max	...	0.13[B]	...
D[C]	heat	0.55 max	0.30	0.04	0.05
	product	0.58 max	0.27	0.048	0.058
DH[C]	heat	0.20–0.55	0.60	0.04	0.05
	product	0.18–0.58	0.57	0.048	0.058

[A] For Grades O, A, and B a sulfur content of 0.23 % max is acceptable with the purchasers approval.
[B] Acid bessemer steel only.
[C] For Grades D and DH a sulfur content of 0.05 – 0.15 % is acceptable provided the manganese is 1.35 % min.

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

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TABLE 2 Chemical Requirements for Grades C3 and DH3 Nuts

Element	Composition, %							
	Classes for Grade C 3 Nuts[A]							Grade DH3 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	0.45 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	0.42 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] C3 nuts may be made of any of the above listed material classes. Selection of the class shall be at the option of the manufacturer.
[B] Nickel or molybdenum may be used.

6.1.2 Jam nuts, slotted nuts, nuts smaller in width across flats or thickness than standard hex nuts (7.1), and nuts that would require a proof load in excess of 160 000 lbf may be furnished on the basis of minimum hardness requirements specified for the grade in Table 3, unless proof load testing is specified in the inquiry and purchase order.

6.2 *Proof Load*:

6.2.1 Nuts of each grade, except those listed in 6.1.2, shall withstand the proof load stress specified for the grade, size, style, thread series, and surface finish of the nut in Table 3 and Table 4.

6.2.2 Nuts hot dip or mechanically zinc coated in accordance with 4.7.2 or 4.7.3 shall be proof load tested after zinc coating and overtapping.[6]

7. Dimensions

7.1 Unless otherwise specified, nuts shall be plain (uncoated) and shall conform to the dimensions prescribed in ANSI B18.2.2.

7.2 Hex and hex-slotted nuts over 1½ to 2 in. inclusive shall have dimensions conforming to ANSI B18.2.2 calculated using the formulas for the 1¼ through 1½-in. size range in Appendix III (Formulas for Nut Dimensions) of ANSI B18.2.2.

7.3 *Threads: Plain (Uncoated) Nuts*

7.3.1 Unless otherwise specified, the threads shall conform to the dimensions for coarse threads with Class 2 B tolerances prescribed in ANSI B1.1.

7.4 *Threads: Nuts Hot Dip Zinc Coated* Specification F 2329(4.7.2)

7.4.1 Nuts to be used on bolts with Class 2A threads before hot-dip zinc coating, and then hot-dip zinc coated in accordance with Specification F 2329, shall be tapped oversize after coating, to the minimum and maximum thread dimensions in Table 5. The major and minor diameters shall also be increased by the allowance to provide the corresponding minimum and maximum major and minor diameters.

7.5 *Threads: Nuts With Other Coatings*

7.5.1 Nuts to be used on bolts mechanically zinc coated or on bolts hot-dip zinc-coated to a specification other than Specification F 2329, or otherwise hot-dip coated, shall be tapped oversize by a diametral amount sufficient to permit assembly on the coated bolt thread, unless other requirements are specified in the inquiry or purchase order.

7.5.2 When specifically permitted by the purchaser, nuts for bolts with electrodeposited coating, such as cadmium, zinc, and so forth, or with chemically applied coating may be tapped

[6] Rotational capacity test procedures, nut rotations, and acceptance criteria are a function of the bolt with which the nuts will be used. When required, they are covered by the applicable bolt specification.

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TABLE 3 Mechanical Requirements
Nuts with UNC, 8 UN, 6 UN and Coarser Pitch Threads

Grade of Nut	Nominal Nut Size, in.	Style of Nut	Proof Load Stress, ksi[A]		Hardness			
			Non-Zinc-Coated Nuts[B]	Zinc-Coated Nuts[B]	Brinell		Rockwell	
					min	max	min	max
O	¼ to 1½	square	69	52	103	302	B55	C32
A	¼ to 1½	square	90	68	116	302	B68	C32
O	¼ to 1½	hex	69	52	103	302	B55	C32
A	¼ to 1½	hex	90	68	116	302	B68	C32
B	¼ to 1	hex	120	90	121	302	B69	C32
B	1⅛ to 1½	hex	105	79	121	302	B69	C32
D[C]	¼ to 1½	hex	135	135	159	352	B84	C38
DH[D]	¼ to 1½	hex	150	150	248	352	C24	C38
DH3	½ to 1	hex	150	150	248	352	C24	C38
A	¼ to 4	heavy hex	100	75	116	302	B68	C32
B	¼ to 1	heavy hex	133	100	121	302	B69	C32
B	1⅛ to 1½	heavy hex	116	87	121	302	B69	C32
C[C]	¼ to 4	heavy hex	144	144	143	352	B78	C38
C3	¼ to 4	heavy hex	144	144	143	352	B78	C38
D[C]	¼ to 4	heavy hex	150	150	159	352	B84	C38
DH[D]	¼ to 4	heavy hex	175	150	248	352	C24	C38
DH3	¼ to 4	heavy hex	175	150	248	352	C24	C38
A	¼ to 1½	hex thick	100	75	116	302	B68	C32
B	¼ to 1	hex thick	133	100	121	302	B69	C32
B	1⅛ to 1½	hex thick	116	87	121	302	B69	C32
D[C]	¼ to 1½	hex thick	150	150	159	352	B84	C38
DH[D]	¼ to 1½	hex thick	175	175	248	352	C24	C38
Nuts with UNF, 12 UN, and Finer Pitch Threads								
O	¼ to 1½	hex	65	49	103	302	B55	C32
A	¼ to 1½	hex	80	60	116	302	B68	C32
B	¼ to 1	hex	109	82	121	302	B69	C32
B	1⅛ to 1½	hex	94	70	121	302	B69	C32
D[C]	¼ to 1½	hex	135	135	159	352	B84	C38
DH[D]	¼ to 1½	hex	150	150	248	352	C24	C38
A	¼ to 4	heavy hex	90	68	116	302	B68	C32
B	¼ to 1	heavy hex	120	90	121	302	B69	C32
B	1⅛ to 1½	heavy hex	105	79	121	302	B69	C32
D[C]	¼ to 4	heavy hex	150	150	159	352	B84	C38
DH[D]	¼ to 4	heavy hex	175	150	248	352	C24	C38
A	¼ to 1½	hex thick	90	68	116	302	B68	C32
B	¼ to 1	hex thick	120	90	121	302	B69	C32
B	1⅛ to 1½	hex thick	105	79	121	302	B69	C32
D[C]	¼ to 1½	hex thick	150	150	159	352	B84	C38
DH[D]	¼ to 1½	hex thick	175	175	248	352	C24	C38

[A] To determine nut proof load in pounds, multiply the appropriate nut proof load stress by the tensile stress area of the thread. Stress areas for UNC, UNF, and 8 UN thread series are given in Table 4.

[B] Non-zinc-coated nuts are nuts intended for use with externally threaded fasteners which have a plain (nonplated or noncoated) finish or have a plating or coating of insufficient thickness to necessitate overtapping the nut thread to provide assemblability. Zinc-coated nuts are nuts intended for use with externally threaded fasteners which are hot-dip zinc-coated, mechanically zinc-coated, or have a plating or coating of sufficient thickness to necessitate overtapping the nut thread to provide assemblability.

[C] Nuts made in accordance to the requirements of Specification A 194/A 194M, Grade 2 or Grade 2H, and marked with their grade symbol are acceptable equivalents for Grades C and D nuts. When A 194 zinc-coated inch series nuts are supplied, the zinc coating, overtapping, lubrication and rotational capacity testing shall be in accordance with Specification A 563.

[D] Nuts made in accordance with the requirements of Specification A 194/A 194M, Grade 2H, and marked with its grade symbol are an acceptable equivalent for Grade DH nuts. When A 194 zinc-coated inch series nuts are supplied, the zinc coating, overtapping, lubrication and rotational capacity testing shall be in accordance with Specification A 563.

oversize by a diametral amount sufficient to permit assembly on the coated bolt thread.

7.5.3 The allowable oversize tapping shall not exceed that specified in Table 5.

8. Workmanship

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

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TABLE 4 Tensile Stress Areas

Nominal Size–Threads per Inch	UNC Tensile Stress Area,[A] A_s in.^{2}	Nominal Size-Threads per Inch	UNF Tensile Stress Area[A] A_s in.^{2}	Nominal Size–Threads per Inch	8 UN Tensile Stress Area,[A] A_s in.^{2}
¼ –20	0.0318	¼ –28	0.0364	...	...
5/16 –18	0.0524	5/16 –24	0.0580	...	...
⅜ –16	0.0775	⅜ –24	0.0878	...	...
7/16 –14	0.1063	7/16 –20	0.1187	...	...
½ –13	0.1419	½ –20	0.1599	...	...
9/16 –12	0.182	9/16 –18	0.203	...	...
⅝ –11	0.226	⅝ –18	0.256	...	...
¾ –10	0.334	¾ –16	0.373	...	...
⅞ –9	0.462	⅞ –14	0.509	...	...
1–8	0.606	1–12	0.663	1–8	0.606
1⅛ –7	0.763	1⅛ –12	0.856	1⅛ –8	0.790
1¼ –7	0.969	1¼ –12	1.073	1¼ –8	1.000
1⅜ –6	1.155	1⅜ –12	1.315	1⅜ –8	1.233
1½ –6	1.405	1½ –12	1.581	1½ –8	1.492
1¾ –5	1.90	...	...	1¾ –8	2.08
2–4½	2.50	...	...	2–8	2.77
2¼ –4½	3.25	...	...	2¼ –8	3.56
2½ –4	4.00	...	...	2½ –8	4.44
2¾ –4	4.93	...	...	2¾ –8	5.43
3–4	5.97	...	...	3–8	6.51
3¼ –4	7.10	...	...	3¼ –8	7.69
3½ –4	8.33	...	...	3½ –8	8.96
3¾ –4	9.66	...	...	3¾ –8	10.34
4–4	11.08	...	...	4–8	11.81

[A] The stress area is calculated as follows:

$$A_s = 0.7854\left[D - \frac{0.9743}{n}\right]^2$$

where:

A_s = stress area, in.^{2},
D = nominal size, in., and
n = threads per inch.

TABLE 5 Thread Dimensions and Overtapping Allowances for Nuts Hot Dip Zinc Coated per Specification F 2329

Nominal Nut Size, in. and Pitch	Diametral Allowance, in.[A]	Pitch Diameter, in. min	Pitch Diameter, in. max
0.250-20	0.016	0.2335	0.2384
0.312-18	0.017	0.2934	0.2987
0.375-16	0.017	0.3514	0.3571
0.437-14	0.018	0.4091	0.4152
0.500-13	0.018	0.4680	0.4745
0.562-12	0.020	0.5284	0.5352
0.625-11	0.020	0.5860	0.5932
0.750-10	0.020	0.7050	0.7127
0.875-9	0.022	0.8248	0.8330
1.000-8	0.024	0.9428	0.9516
1.125-8	0.024	1.0678	1.0768
1.125-7	0.024	1.0562	1.0656
1.250-8	0.024	1.1928	1.2020
1.250-7	0.024	1.1812	1.1908
1.375-8	0.027	1.3208	1.3301
1.375-6	0.027	1.2937	1.3041
1.500-8	0.027	1.4458	1.4553
1.500-6	0.027	1.4187	1.4292
1.750-5	0.050	1.6701	1.6817
2.000-4.5	0.050	1.9057	1.9181
2.250-4.5	0.050	2.1557	2.1683
2.500-4	0.050	2.3876	2.4011
2.750-4	0.050	2.6376	2.6513
3.000-4	0.050	2.8876	2.9015
3.250-4	0.050	3.1376	3.1517
3.500-4	0.050	3.3876	3.4019
3.750-4	0.050	3.6376	3.6521
3.750-4	0.050	3.6376	3.6521
4.000-4	0.050	3.8876	3.9023

[A] These allowances also apply to the minimum and maximum major and minor diameters.

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. 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 material offered for inspection at one time that has the following common characteristics:

9.2.1 Grade,
9.2.2 Nominal size,
9.2.3 Style of nut,
9.2.4 Thread series and class, and
9.2.5 Surface finish.

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

Number of Nuts in Lot	Number of Specimens
800 and under	1
801 to 8 000	2
8 001 to 22 000	3
Over 22 000	5

9.4 If any test specimen shows flaws, it may be discarded and another specimen substituted.

9.5 Should any specimen fail to meet the requirements of any specified test, double the number of specimens from the same lot shall be tested for this property, in which case all of the additional specimens shall meet the specifications.

10. Test Methods

10.1 Tests shall be conducted in accordance with Test Methods F 606.

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 the 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 inspections required by the specification that are requested by the purchaser's representative shall be made before shipment, and shall be conducted as not to interfere unnecessarily with the operation of the works.

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13. Rejection and Rehearing

13.1 Material that fails to conform to the requirements of this specification may be rejected. Rejection should be reported to the producer or supplier promptly and in writing. In case of dissatisfaction with the results of the test, the producer or supplier may make claim for a rehearing.

14. Product Marking

14.1 Nuts made to the requirements of Grades O, A, and B are not required to be marked unless individual marking is specified in the inquiry and order. When individual marking is required, the mark shall be the grade letter symbol on one face of the nut.

14.2 Heavy hex nuts made to the requirements of Grade C (Note 4) shall be marked on one face with three circumferential marks 120° apart.

14.3 Heavy hex nuts made to the requirements of Grade C3 shall be marked on one face with three circumferential marks 120° apart and the numeral 3. In addition, the manufacturer may add other distinguishing marks indicating that the nut is atmospheric corrosion resistant and of a weathering type.

14.4 Nuts made to the requirements of Grade D shall be marked with the grade symbol, D (Note 4) on one face.

14.5 Nuts made to the requirements of Grade DH shall be marked with the grade symbol, DH (Note 4) on one face.

14.6 Heavy hex nuts made to the requirements of Grade DH3 shall be marked with the grade symbol DH3 on one face. Hex nuts made to the requirements of DH3 shall be marked with the symbol HX3 on one face. In addition, the manufacturer may add other distinguishing marks indicating that the nut is atmospheric corrosion resistant and of a weathering type.

14.7 In addition, nuts of Grades C, C3, D, DH, and DH3 and hex nuts made to the requirements of DH3, shall be marked with a symbol to identify the manufacturer or private label distributor, as appropriate.

14.8 Marks may be raised or depressed at the option of the manufacturer. However, if markings are located on the bearing surface, they shall be depressed.

14.9 Grade 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.

NOTE 4—See Table 3 for marking of equivalent nuts made in accordance with requirements of Specification A 194/A 194M.

15. Packaging and Package Marking

15.1 *Packaging:*

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

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

15.2 *Package Marking:*

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

15.2.1.1 ASTM designation and grade,

15.2.1.2 Size,

15.2.1.3 Name and brand or trademark of the manufacturer,

15.2.1.4 Number of pieces,

15.2.1.5 Purchase order number, and

15.2.1.6 Country of origin.

16. Responsibility

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

17. Keywords

17.1 alloy steel; carbon steel; nuts; steel; weathering steel

SUPPLEMENTARY REQUIREMENTS

The following supplementary requirement shall be applied only when specified by the purchaser on the contract or order. Details of these supplementary requirements shall be agreed upon in writing between the manufacturer and purchaser. This supplementary requirement shall in no way negate any requirement of the specification itself.

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 it's presence is visually obvious.

S3. Lubricant Placement

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

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APPENDIX

(Nonmandatory Information)

X1. INTENDED APPLICATION

X1.1 Table X1.1 gives additional information for the intended application of nuts.

TABLE X1.1 Nut and Bolt Suitability Guide

Grade of Bolt[D]	Surface Finish[E]	Nominal Size, in.	A563 Grade and ANSI Nut Style[A]					
			Recommended[B]		Suitable[C]			
			Hex	Heavy Hex	Square	Hex	Heavy Hex	Hex Thick
A 307 Grade A	non-zinc-coated and zinc-coated	¼ to 1½	A	...	A	B,D,DH	A,B,C,D,DH,DH3	A,B,D,DH
		>1½ to 2	...	A	...	A[F]	C,D,DH,DH3	...
		>2 to 4	...	A	...	...	C,D,DH,DH3	...
A 307 Grade B	non-zinc-coated and zinc-coated	¼ to 1½	...	A	A	B,D,DH	B,C,D,DH,DH3	A,B,D,DH
		>1½ to 2	...	A	...	A[F]	C,D,DH,DH3	...
		>2 to 4	...	A	...	...	C,D,DH,DH3	...
A 325 Type 1	non-zinc-coated	½ to 1½	...	C	...	...	C3,D,DH,DH3	...
	zinc-coated	½ to 1½	...	DH	...	...	...	...
A 325 Type 3	non-zinc-coated	½ to 1½	...	C3	...	...	DH3	...
A 354 Grade BC	non-zinc-coated	¼ to 1½	...	C	...	D,DH	C3,D,DH,DH3	D,DH
		>1½ to 4	...	C	...	...	C3,D,DH,DH3	...
	zinc-coated	¼ to 1½	...	DH	...	...	...	DH
		>1½ to 4	...	DH	...	...	...	...
A 354 Grade BD	non-zinc-coated	¼ to 1½	...	DH	...	DH	D,DH,DH3	D,DH
		>1½ to 4	...	DH	...	...	DH3	...
A 394 Type 0	zinc-coated	½ to 1	A	...	...	B,D	...	...
A 394 Types 1 and 2	zinc-coated	½ to 1	DH	...	...	D	...	...
A 394 Type 3	non-zinc-coated	½ to 1	DH3	...	...	...	C3	...
A 449 Types 1 and 2	non-zinc-coated	¼ to 1½	B	...	...	D,DH	B,C,C3,D,DH,DH3	B,D,DH
		>1½ to 3	...	A	...	...	C,C3,D,DH,DH3	...
	zinc-coated	¼ to 1½	...	DH	...	D,DH	D	D,DH
		>1½ to 3	...	DH	...	...	D	...
A 490 Types 1 and 2	non-zinc-coated	½ to 1½	...	DH	...	...	DH3	...
A 490 Type 3	non-zinc-coated	½ to 1½	...	DH3	...	...	...	...
A 687	non-zinc-coated	1¼ to 3	...	D	...	...	DH,DH3	...
	zinc-coated	1¼ to 3	...	DH	...	...	...	...

[A] The availability of DH nuts in nominal sizes ¾ in. and larger is very limited and generally available only on special orders for 50 000 pieces or more. For smaller quantities A194 Gr. 2H nuts should be considered.

[B] "Recommended" denotes a commercially available nut having the most suitable mechanical properties and dimensional configuration (style) that will make it possible to torque the bolt to the required load when used in combination with the nut.

[C] "Suitable" denotes nuts having mechanical properties that will make it possible to torque the bolt to the required load when used in combination with the nut; but, which require consideration of dimensional configuration (style) suitability and availability. Others are not suitable.

[D] The term "bolt" includes all externally threaded types of fasteners.

[E] Non-zinc-coated nuts are nuts intended for use with externally threaded fasteners which have a plain (nonplated or noncoated) finish or have a plating or coating of insufficient thickness to necessitate overtapping the nut thread to provide assemblability. Zinc-coated nuts are nuts intended for use with externally threaded fasteners which are hot-dip zinc-coated, mechanically zinc-coated, or have a plating or coating of sufficient thickness to necessitate overtapping the nut thread to provide assemblability.

[F] Hex nuts in nominal sizes over 1½ to 2 in. inclusive are not covered in the tables of tabulated sizes in ANSI B18.2.2 but are commercially available. Such nuts are suitable. See 7.2 for dimensions.

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SUMMARY OF CHANGES

Committee F16 has identified the location of selected changes to this standard since the last issue (A 563–07) 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 made to this standard since the last issue, A 563–04a, that may impact the use of this standard.

(*1*) Changed the reference hot dip zinc coating specification from Specification A 153/A 153M Gr. C, to Specification F 2329.

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