Designation: ~~A563 – 15~~ A563/A563M – 21

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

This standard is issued under the fixed designation ~~A563;~~A563/A563M; 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 U.S. Department of Defense.

1. Scope*

1.1 This specification[2] covers chemical and mechanical requirements for ~~eight~~eleven 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 A242/A242M, A588/A588M, and A709/A709M. 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 A563 has been developed—A563M; therefore, no metric equivalents are presented in this specification.~~

1.3 Terms used in this specification are defined in Terminology F1789 unless otherwise defined herein.

1.4 The values stated in either SI units or inch-pound units are to be regarded separately as standard. The values stated in each system are not necessarily exact equivalents; therefore, to ensure conformance with the standard, each system shall be used independently of the other, and values from the two systems shall not be combined.

1.5 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*[3]

[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 – 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.

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

A194/A194M Specification for Carbon Steel, Alloy Steel, and Stainless Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both
~~A242/A242M Specification for High-Strength Low-Alloy Structural Steel~~
A307 Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength
~~A325 Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength (Withdrawn 2016)[4]~~
A354 Specification for Quenched and Tempered Alloy Steel Bolts, Studs, and Other Externally Threaded Fasteners
A394 Specification for Steel Transmission Tower Bolts, Zinc-Coated and Bare
A449 Specification for Hex Cap Screws, Bolts and Studs, Steel, Heat Treated, 120/105/90 ksi Minimum Tensile Strength, General Use
~~A490 Specification for Structural Bolts, Alloy Steel, Heat Treated, 150 ksi Minimum Tensile Strength (Withdrawn 2016)[4]~~
~~A563M Specification for Carbon and Alloy Steel Nuts (Metric)~~
~~A588/A588M Specification for High-Strength Low-Alloy Structural Steel, up to 50 ksi [345 MPa] Minimum Yield Point, with Atmospheric Corrosion Resistance~~
~~A687 Specification for High-Strength Nonheaded Steel Bolts and Studs (Withdrawn 1999)[4]~~
~~A709/A709M Specification for Structural Steel for Bridges~~
A751 Test Methods and Practices for Chemical Analysis of Steel Products
B695 Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel
~~D3951 Practice for Commercial Packaging~~
~~F606~~F606/F606M Test Methods for Determining the Mechanical Properties of Externally and Internally Threaded Fasteners, Washers, ~~and Rivets (Metric) F0606_F0606M~~ Direct Tension Indicators, and Rivets
~~F812/F812M~~F812 Specification for Surface Discontinuities of Nuts, Inch and Metric Series
F1136/F1136M Specification for Zinc/Aluminum Corrosion Protective Coatings for Fasteners
F1470 Practice for Fastener Sampling for Specified Mechanical Properties and Performance Inspection
F1554 Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength
F1789 Terminology for F16 Mechanical Fasteners
F1941/F1941M Specification for Electrodeposited Coatings on Mechanical Fasteners, Inch and Metric
~~F2329~~F2329/F2329M Specification for Zinc Coating, Hot-Dip, Requirements for Application to Carbon and Alloy Steel Bolts, Screws, Washers, Nuts, and Special Threaded Fasteners
F2833 Specification for Corrosion Protective Fastener Coatings with Zinc Rich Base Coat and Aluminum Organic/Inorganic Type
F3019/F3019M Specification for Chromium Free Zinc-Flake Composite, with or without Integral Lubricant, Corrosion Protective Coatings for Fasteners
F3125/F3125M Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength
F3148 Specification for High Strength Structural Bolt Assemblies, Steel and Alloy Steel, Heat Treated, 144ksi Minimum Tensile Strength, Inch Dimensions
F3393 Zinc-Flake Coating Systems for Fasteners
G101 Guide for Estimating the Atmospheric Corrosion Resistance of Low-Alloy Steels

2.2 *~~ANSI~~ASME Standards:*[4]
~~ANSI~~ASME B1.1 Unified Screw Threads
~~ANSI~~ASME B18.2.2 Square and Hex Nuts
ASME B18.2.6 Fasteners for Use in Structural Applications
ASME B18.2.6M Metric Fasteners for Use in Structural Applications
ASME B1.13M Metric Screw Threads-M Profile

2.3 *SAE Standard:*[5]
SAE J995 Mechanical and Material Requirements for Steel Nuts

3. Ordering Information

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

3.1.1 Quantity (number of nuts),

[4] ~~The last approved version of this historical standard is referenced on www.astm.org.~~Available from American Society of Mechanical Engineers (ASME), ASME International Headquarters, Two Park Ave., New York, NY 10016-5990, http://www.asme.org.

[5] Available from ~~American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, http://www.ansi.org.~~SAE International (SAE), 400 Commonwealth Dr., Warrendale, PA 15096, http://www.sae.org.

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,~~Coatings or finishes: If other than plain finish, specify the coating process or finish required, see ~~4.7~~4.4~~),~~ and Annex A1.

~~3.1.6 *Other Finishes*—Specify other protective finish if required,~~

3.1.6 ASTM designation and year of issue, and

3.1.7 Any special observation or inspection requirements shall be specified at the time of inquiry and at the time of order. See 11.2.

3.1.8 Supplementary or special requirements.

NOTE 2—An example of an ordering description follows: 1000 7/8-9 heavy hex nuts, Grade DH, hot-dip zinc-coated, and lubricated, ASTM A563–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,~~ 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.~~ *Manufacturing Method:*

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

4.2.2 Threads shall be formed by tapping or machining.

~~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.~~

4.3 ~~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.~~ *Heat Treatment:*

4.3.1 Grades DH, DH33, 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 800 °F or 425 °C.

4.3.2 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 or 425 °C.

~~4.6 Threads shall be formed by tapping or machining.~~

4.4 ~~*Zinc Coatings, Hot-Dip and Mechanically Deposited:*~~*Coatings and Other Finishes:*

4.4.1 Permitted coatings, including supplementary lubrication and nut overtap requirements are provided in Annex A1.

4.4.2 When ~~zinc-coated~~coated fasteners are required, the purchaser shall specify the ~~zinc coating process, for example, hot-dip, mechanically deposited, or no preference.~~ process and any additional special requirements.

~~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 F2329.~~

~~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 B695.~~

4.4.3 ~~When no preference is specified, the supplier may furnish either a hot-dip zinc coating in accordance with Specification~~ Hot-dip and ~~F2329, or a~~ mechanically deposited zinc ~~coating in accordance with Specification~~ threaded ~~B695, Class 55. Threaded~~ components (bolts and nuts) shall be coated by the same ~~zinc-coating process and the supplier's option is~~ process, 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.~~

4.4.4 ~~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~~Hot-dip and mechanical deposited zinc and Zn/Al coating overtap allowances are specified in 7.4~~afterwards.~~.

4.5 *Lubricant:*

4.5.1 Hot-dip and mechanically deposited zinc-coated Grade DH and 10S 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).

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

5. Chemical Composition

5.1 Grades ~~O,~~ A, B, C, D, DH, 8S, and ~~DH~~10S shall conform to the chemical composition specified in Table 1.

5.2 Grades C3 DH3, 8S3, and ~~DH3 shall~~ 10S3 shall be weathering steel and conform to the chemical composition specified in Table ~~2~~1. Compositions A or B may be used for grades C3 and 8S3. Optionally, a chemical composition based on a corrosion index may be used provided the steel meets the chemical requirements in Table 1 column headed "Based on Corrosion Index". When certifying based on the corrosion index the steel shall have a corrosion index of 6 or greater, as calculated from the heat analysis, and as described in Guide G101, using the predictive method based on the data of Larabee and Coburn, or the predictive method based on the data of Townsend. See Guide G101 for methods of estimating the atmospheric corrosion resistance of low alloy steels.

5.3 If performed, product analysis made on finished nuts representing each lot shall be within 10 % of the value required of the heat analysis. For example heat analysis C 0.30-0.52 = product analysis C 0.27-0.57.

5.4 Resulfurized or rephosphorized steel, or both, are not subject to rejection based on product analysis for sulfur or phosphorus.

5.5 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.~~ permitted.

5.6 Chemical analyses shall be performed in accordance with Test Methods, Practices, and Terminology A751.

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~~ Nuts shall conform to the hardness in Table ~~3~~2.

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~~2, unless proof load testing is specified in the inquiry and purchase order.

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

~~Grade of Nut~~	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~~

TABLE 1 Chemical Requirements[A]

Nut Grade	A, B, C, 8S	C3, 8S3			D	DH, 10S	DH3, 10S3	
Heat Analysis	Composition %	Composition A %	Composition B %	Based on Corrosion Index[D]	Composition %		Composition %	Based on Corrosion Index[C]
Carbon	0.55 max	0.33-0.40	0.38-0.48	0.30-0.53	0.55 max	0.20-0.55	0.20-0.53	0.30-0.53
Manganese	...	0.90-1.20	0.70-0.90	0.60 min	0.30 min	0.60 min	0.40 min	0.60 min
Phosphorus, max	0.12	0.035	0.035	0.035	0.04	0.04	0.035	0.035
Sulfur, max	0.15[D]	0.040	0.040	0.040	0.05[E]	0.05[E]	0.040	0.040
Silicon	[B]	0.15-0.35	0.30-0.50	[B]	[B]	[B]	[B]	[B]
Copper	[B]	0.25-0.45	0.20-0.40	0.20-0.60	[B]	[B]	0.20 min	0.20-0.60
Nickel	[B]	0.25-0.45	0.50-0.80	0.20[F] min	[B]	[B]	0.20 min	0.20[F] min
Chromium	0.45-0.65	0.50-0.75	0.45 min	[B]	[B]	[B]	0.45 min	0.45 min
Vanadium	[B]	[B]	[B]	[B]	[B]	[B]	[B]	[B]
Molybdenum	[B]	[B]	0.10[F] min	0.10[F] min	[B]	[B]	0.15 min	0.10F min
Titanium	[B]	[B]	[B]	[B]	[B]	[B]	[B]	[B]

[A] Based on heat analysis. See 5.3 for product analysis requirements.
[B] Not specified.
[C] See 5.2.
[D] For Grades ~~O,~~ A, B, and ~~B~~8S a sulfur content of 0.23 % max is acceptable with the purchasers approval.
~~[B] Acid bessemer steel only.~~
[E] For Grades ~~D~~ D, DH, and ~~DH~~10S a sulfur content of 0.05 – 0.15 % is acceptable provided the manganese is 1.35 % min.

~~**TABLE 2 Chemical Requirements for Grades C3 and DH3 Nuts**~~

~~Element~~	~~Composition, %~~							
	~~Classes for Grade C3 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]

Element	Composition, %							
	Classes for Grade C3 Nuts[A]							Grade DH3 Nuts
	N	A	B	C	D	E	F	
Product analysis	...	...	0.07 max	...	0.11 max	...	...	0.14 min
Titanium:								
Heat analysis	...	...	...	...	0.05 max	...	...	...
Product analysis	...	...	...	...	...	...	...	...

[F] 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. Either Nickel or Molybdenum must be present in the amount specified.
[B] Nickel or molybdenum may be used.

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 32 and Table 43.

6.2.2 Nuts hot dip or mechanically zinc coated overtapped to accommodate coating thickness in accordance with 4.7.27.4 or 4.7.3shall be proof load tested after zinc coating and overtapping.[6]

6.2.3 Proof load testing shall be performed by the manufacturer on all grades having a specified proof load up to 160 000 lbf or 705 kN. Unless Supplementary Requirement S5 is invoked in the purchase order or contract, nuts having specified proof load greater than 160 000 lbf or 705 kN shall be proof load tested or cross-sectional hardness tested by the manufacturer in accordance with test Methods F606/F606M. In all cases, proof load testing shall take precedence over hardness testing in the event a conflict exists relative to minimum strength.

7. Dimensions

7.1 Unless otherwise specified, nuts shall be plain (uncoated) and (uncoated). Inch nuts shall conform to the dimensions specified in ASME B18.2.2. Heavy Hex Inch Nuts for use in structural applications in Grades C, C3, D, DH, and DH3 shall conform to the dimensions prescribed in ANSI B18.2.2. specified in ASME B18.2.6. Metric structural nuts shall conform to the dimensions specified in ASME B18.2.6M.

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

7.3 *Threads: Plain (Uncoated) Nuts*

7.3.1 Unless otherwise specified, theInch threads shall conform to the dimensions for coarse threads with Class 2 B tolerances prescribedspecified in ANSI B1.1. ASME B1.1. Metric threads shall conform to the dimensions for coarse series threads with Class 6H tolerances specified in ASME B1.13M.

7.4 *Threads: Nuts Hot Dip and mechanically Zinc Coated and Zn/Al Coated:* Specification F2329(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 F2329F2329/F2329M, shall be tapped oversize overtapped 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. When specified by the purchaser, lower overtap values are permitted as long as it is sufficient to permit free assembly with hot-dip zinc coated bolts.

7.4.2 Nuts to be used on bolts with Class 2A threads before mechanical deposited zinc coating and then mechanical deposited zinc coated in accordance with Specification B695 Class 50 and higher shall be overtapped prior to zinc coating to the minimum and maximum dimensions in Table 5. The major and minor diameters shall also be increased by the allowance to provide the

[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.

TABLE ~~3~~2 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~~
A	¼ to 4	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~~
A	¼ to 4	hex	90	68	116	302	B68	C32
B[G]	¼ to 1	hex	120	90	121	302	B69	C32
B[G]	1⅛ to 1½	hex	105	79	121	302	B69	C32
~~C[E]~~	~~¼ to 1½~~	~~hex~~	~~130~~	~~130~~	~~143~~	~~352~~	~~B78~~	~~C38~~
C[E]	¼ to 4	hex	130	130	143	352	B78	C38
~~D[C]~~	~~¼ to 1½~~	~~hex~~	~~135~~	~~135~~	~~159~~	~~352~~	~~B84~~	~~C38~~
D[C]	¼ to 4	hex	135	135	159	352	B84	C38
~~DH[D]~~	~~¼ to 1½~~	~~hex~~	~~150~~	~~150~~	~~248~~	~~352~~	~~C24~~	~~C38~~
DH[D]	¼ to 4	hex	150	150	248	352	C24	C38
~~DH3~~	~~½ to 1~~	~~hex~~	~~150~~	~~150~~	~~248~~	~~352~~	~~C24~~	~~C38~~
DH3	½ to 4	hex	150	150	248	352	C24	C38
A	¼ to 4	heavy hex	100	75	116	302	B68	C32
B[G]	¼ to 1	heavy hex	133	100	121	302	B69	C32
B[G]	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[G]	¼ to 1	hex thick	133	100	121	302	B69	C32
B[G]	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~~
A	¼ to 4	hex	80	60	116	302	B68	C32
B[G]	¼ to 1	hex	109	82	121	302	B69	C32
B[G]	1⅛ to 1½	hex	94	70	121	302	B69	C32
~~D[C]~~	~~¼ to 1½~~	~~hex~~	~~135~~	~~135~~	~~159~~	~~352~~	~~B84~~	~~C38~~
D[C]	¼ to 4	hex	135	135	159	352	B84	C38
~~DH[D]~~	~~¼ to 1½~~	~~hex~~	~~150~~	~~150~~	~~248~~	~~352~~	~~C24~~	~~C38~~
DH[D]	¼ to 4	hex	150	150	248	352	C24	C38
A	¼ to 4	heavy hex	90	68	116	302	B68	C32
B[G]	¼ to 1	heavy hex	120	90	121	302	B69	C32
B[G]	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[G]	¼ to 1	hex thick	120	90	121	302	B69	C32
B[G]	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
Grade of Nut	Nominal Nut Size, metric	Style of Nut	Proof Load Stress, MPa		Hardness			
			Non-Zinc-Coated Nuts[B]	Zinc-Coated Nuts[B]	Vickers		Rockwell	
					min	max	min	max
8S and 8S3	M12 to M36	heavy hex	1075	N/A	188	372	B89	C38
10S and 10S3	M12 to M36	heavy hex	1245	1165[F]	272	372	C26	C38

[A] To determine nut proof load in ~~pounds,~~ pounds or Newtons, 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~~3. Stress areas for metric threads are given in Table 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.