



Designation: A563/A563M – 21a^{ε1}

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

This standard is issued under the fixed designation 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.

^{ε1} NOTE—Table 2 was editorially corrected in March 2022.

1. Scope*

1.1 This specification² covers chemical and mechanical requirements for 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 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.*

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.

2. Referenced Documents

2.1 *ASTM Standards*:³

- [A194/A194M](#) Specification for Carbon Steel, Alloy Steel, and Stainless Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both
- [A307](#) Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength
- [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
- [A751](#) Test Methods and Practices for Chemical Analysis of Steel Products
- [B695](#) Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel
- [F606/F606M](#) Test Methods for Determining the Mechanical Properties of Externally and Internally Threaded Fasteners, Washers, Direct Tension Indicators, and Rivets
- [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

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

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 Specification for Zinc-Flake Coating Systems for Fasteners

G101 Guide for Estimating the Atmospheric Corrosion Resistance of Low-Alloy Steels

2.2 ASME Standards:⁴

ASME B1.1 Unified Screw Threads

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),

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 *Coatings or finishes*—If other than plain finish, specify the coating process or finish required, see 4.4 and Annex A1.

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 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 SAE International (SAE), 400 Commonwealth Dr., Warrendale, PA 15096, <http://www.sae.org>.

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 A and B nuts may be made by the acid-bessemer process.

4.2 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 Heat Treatment:

4.3.1 Grades DH, DH3, 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.

4.4 Coatings and Other Finishes:

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

4.4.2 When coated fasteners are required, the purchaser shall specify the process and any additional special requirements.

4.4.3 Hot-dip and mechanically deposited zinc threaded components (bolts and nuts) shall be coated by the same process, limited to one process per item with no mixed processes in a lot.

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

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

5.2 Grades C3, DH3, 8S3, and 10S3 shall be weathering steel and conform to the chemical composition specified in Table 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.

TABLE 1 Chemical Requirements^A

Nut Grade	A, B, C, 8S		C3, 8S3	Based on Corrosion Index ^C	D	DH, 10S	DH3, 10S3	
	Composition %	Composition A %	Composition B %		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	^B	0.45-0.65	0.50-0.75	0.45 min	^B	^B	0.45 min	0.45 min
Vanadium	^B	^B	^B	^B	^B	^B	^B	^B
Molybdenum	^B	^B	0.06 max	0.10 ^F min	^B	^B	0.15 min	0.10 ^F 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 A, B, and 8S a sulfur content of 0.23 % max is acceptable with the purchasers approval.

^E For Grades D, DH, and 10S a sulfur content of 0.05 – 0.15 % is acceptable provided the manganese is 1.35 % min.

^F Either Nickel or Molybdenum must be present in the amount specified.

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.

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 Nuts shall conform to the hardness in Table 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 2, 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 2, Table 3, and Table 4.

6.2.2 Nuts overlapped to accommodate coating thickness in accordance with 7.4 shall be proof load tested after 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

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.

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). 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 specified in ASME B18.2.6. Metric structural nuts shall conform to the dimensions specified in ASME B18.2.6M.

7.2 Hex-slotted nuts over 1½ to 2 in. inclusive shall have dimensions conforming to ASME B18.2.2 calculated using the formulas for the ¼ through ½-in. size range in Appendix A (Formulas for Nut Dimensions) of ASME B18.2.2.

7.3 Threads: Plain (Uncoated) Nuts

7.3.1 Unless otherwise specified, inch threads shall conform to the dimensions for coarse threads with Class 2 B tolerances specified in 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:

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 F2329/F2329M, shall be overlapped 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 overlap values are permitted as long as it is sufficient to permit free assembly with hot-dip zinc coated bolts.

TABLE 2 Mechanical Requirements

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
A	¼ to 1½ [†]	square	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 4	hex	130	130	143	352	B78	C38
D ^C	¼ to 4	hex	135	135	159	352	B84	C38
DH ^D	¼ to 4	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 ^{F†}	248	352	C24	C38
DH3	¼ to 4	heavy hex	175	150 ^{F†}	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								
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 4	hex	135	135	159	352	B84	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 ^{F†}	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	
8S and 8S3	M12 to M36	heavy hex	1075	N/A	min	max	min	max
10S and 10S3	M12 to M36	heavy hex	1245	1165 ^F	188	372	B89	C38
					272	372	C26	C38

^A To determine nut proof load in 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 3. Stress areas for metric threads 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 overlapping 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 overlapping the nut thread to provide assemblability.

^C Nuts made in accordance to the requirements of Specification A194/A194M, Grade 2 or Grade 2H, and marked with their grade symbol are acceptable equivalents for Grades C heavy hex and hex and D nuts. When A194/A194M zinc-coated inch series nuts are supplied, the zinc coating, overlapping, and lubrication shall be in accordance with the requirements of this specification. Rotational Capacity test procedures, nut rotations, and acceptance criteria are a function of the bolt with which the nuts will be used. When required, testing for the assembly in which the nut is used shall be in accordance with the applicable bolt specification.

^D Nuts made in accordance with the requirements of Specification A194/A194M, Grade 2H, and marked with its grade symbol are an acceptable equivalent for Grade DH nuts. When A194/A194M zinc-coated inch series nuts are supplied, the zinc coating, overlapping, and lubrication shall be in accordance with the requirements with this specification. Rotational Capacity test procedures, nut rotations, and acceptance criteria are a function of the bolt with which the nuts will be used. When required, testing for the assembly in which the nut is used shall be in accordance with the applicable bolt specification.

^E ASTM A194/A194M Grades 2 or 2H shall not be supplied for Grade C hex nuts unless approved by purchaser.

^F Overtapped nuts intended to be used with 150 ksi bolts or equivalent shall be proof load tested at 175 ksi. Metric overtapped nuts intended to be used with 1040 MPa bolts or equivalent shall be proof load tested at 1245 MPa. When overtapped nuts will be used with 150 ksi bolts or equivalent, proof load requirements for overtapped nuts shall be specified by the purchaser in the inquiry and purchase order.

^G Nuts made in accordance with the requirements of SAE J995 Grade 5 and marked with its grade symbol are an acceptable equivalent for Grade B nuts.

[†] Editorially corrected in March 2022.

TABLE 3 Tensile Stress Areas—Inch

Nominal Size—Threads per Inch	UNC		Nominal Size—Threads per Inch	UNF		Nominal Size—Threads per Inch	8 UN	
	Tensile Stress Area, ^A A _s in. ²			Tensile Stress Area, ^A A _s in. ²			Tensile Stress Area, ^A A _s in. ²	
¼–20	0.0318		¼–28	0.0364		...	...
⅜–18	0.0524		⅜–24	0.0580		...	...
⅝–16	0.0775		⅝–24	0.0878		...	...
⅞–14	0.1063		⅞–20	0.1187		...	...
1–13	0.1419		1–20	0.1599		...	...
1 ⅛–12	0.182		1 ⅛–18	0.203		...	...
1 ¼–11	0.226		1 ¼–18	0.256		...	...
1 ½–10	0.334		1 ½–16	0.373		...	...
1 ¾–9	0.462		1 ¾–14	0.509		...	...
1–8	0.606		1–12	0.663		1–8	0.606	
1 ⅛–7	0.763		1 ⅛–12	0.856		1 ⅛–8	0.790	
1 ¼–7	0.969		1 ¼–12	1.073		1 ¼–8	1.000	
1 ⅝–6	1.155		1 ⅝–12	1.315		1 ⅝–8	1.233	
1 ¾–6	1.405		1 ¾–12	1.581		1 ¾–8	1.492	
1 ⅞–5	1.90		...	...		1 ⅞–8	2.08	
2–4 ½	2.50		...	...		2–8	2.77	
2 ¼–4 ½	3.25		...	...		2 ¼–8	3.56	
2 ½–4	4.00		...	...		2 ½–8	4.44	
2 ¾–4	4.93		...	...		2 ¾–8	5.43	
3–4	5.97		...	...		3–8	6.51	
3 ¼–4	7.10		...	...		3 ¼–8	7.69	
3 ½–4	8.33		...	...		3 ½–8	8.96	
3 ¾–4	9.66		...	...		3 ¾–8	10.34	
4–4	11.08		...	...		4–8	11.81	

^AA_s The inch stress area is calculated as follows:

$$A_s = 0.7854 (D - (0.9743 / n))^2$$

 where: A_s = stress area, in.², D = nominal size, (in.), and n = threads per in.

TABLE 4 Tensile Stress Areas - Metric

Nominal size and thread pitch	Tensile stress area ^A A _s , mm ²
M12×1.75	84.3
M16×2.0	157
M20×2.5	245
M22×2.5	303
M24×3.0	353
M27×3.0	459
M30×3.5	561
M36×4.0	817

^AA_s the metric stress area is calculated as follows:

$$A_s = 0.7854 (D - 0.9382P)^2$$

 where: A_s = Stress Area (mm²), D = Nominal Nut Size (mm), and P = thread pitch (mm)

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 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 mechanically deposited zinc coated bolts.

7.4.3 Nuts to be used with bolts with Class 2A threads before coating is applied and then Zn/Al coated in accordance with F1136/F1136M, F2833, or F3019/F3019M 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 correspond-

ing 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 Zn/Al coated bolts.

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 F2329/F2329M, or otherwise hot-dip coated, shall be overtapped 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 overtapped by a diametral amount sufficient to permit assembly on the coated bolt thread.

7.5.3 The allowable overtap amount shall not exceed that specified in Table 5.

8. Testing Lot and Control

8.1 Testing Responsibility:

8.1.1 Each lot shall be tested by the manufacturer prior to shipment in accordance with the lot control and identification quality assurance plan in 8.2 – 8.5.

8.1.2 When supplied by a source other than the manufacturer, the responsible party shall assure all tests have been performed and the nuts conform to this specification.

8.2 Nuts shall be processed in accordance with a lot control and identification quality assurance plan. The manufacturer, secondary processors, and distributors shall identify and maintain the integrity of each production lot from raw material through all processing operations to final packing and shipment. Each lot shall be assigned a unique lot identification number, each lot shall be tested, and the lot inspection test reports retained.

8.3 Secondary processing shall maintain lot integrity and shall be traceable to the original lot at time of manufacture.

8.4 A lot shall be a quantity of uniquely identified nuts of the same nominal size produced consecutively at the initial operation from a single mill heat of material and processed at one time, by the same process, in the same manner so that statistical sampling is valid.

NOTE 3—The purpose of a lot inspection and control program is to ensure that each lot conforms to this specification and that lot integrity is maintained to the point of use. It is essential that secondary processors, distributors, and users maintain lot identification and integrity until installation.

8.5 Number of Tests:

8.5.1 The minimum number of tests required from each lot shall be in accordance with Practice F1470. These tests and sample numbers are for final inspection only and shall be in addition to the manufacturer's established internal quality control system and in-process inspection procedures.

8.5.2 Disposition of non-conforming product shall be in accordance with Practice F1470.

NOTE 4—Section 8.5.1 is intended to identify a statistically large

TABLE 5 Thread Dimensions and Overtapping Allowances for Coated Nuts

Nominal Nut Size, in. and Pitch	Diametral Allowance, in. ^A	Galvanized F2329/F2329M/B695		Zn/Al Coatings F1136/F1136M/F2833/F3019/F3019M		
		Pitch Diameter, in.		Diametral Allowance, in. ^A	Pitch Diameter, in.	
		min	max		min	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	0.009	0.4590	0.4655
0.562-12	0.020	0.5284	0.5352			
0.625-11	0.020	0.5860	0.5932	0.010	0.5760	0.5832
0.750-10	0.020	0.7050	0.7127	0.010	0.6950	0.7027
0.875-9	0.022	0.8248	0.8330	0.011	0.8138	0.8220
1.000-8	0.024	0.9428	0.9516	0.012	0.9308	0.9396
1.125-8	0.024	1.0678	1.0768			
1.125-7	0.024	1.0562	1.0656	0.012	1.0442	1.0536
1.250-8	0.024	1.1928	1.2020			
1.250-7	0.024	1.1812	1.1908	0.012	1.1692	1.1888
1.375-8	0.027	1.3208	1.3301			
1.375-6	0.027	1.2937	1.3041	0.014	1.2807	1.2911
1.500-8	0.027	1.4458	1.4553			
1.500-6	0.027	1.4187	1.4292	0.014	1.4057	1.4162
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			
Nominal Nut Size, in. and Pitch	Diametral Allowance, μm . ^A	Pitch Diameter, mm		Diametral Allowance, μm . ^A	Pitch Diameter, mm	
		min	max		min	max
M12x1.75	365	11.228	11.428	230	11.093	11.293
M16x2	420	15.121	15.333	250	14.951	15.163
M20x2.5	530	18.906	19.130	250	18.626	18.850
M22x2.5	530	20.906	21.130	280	20.656	20.880
M24x3	640	23.141	22.956	300	22.351	22.616
M27x3	640	25.691	25.956	300	25.351	25.616
M30x3.5	750	28.477	28.757	350	28.077	28.357
M36x4	860	34.262	34.562	350	33.752	34.052

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

number of non-conformances but does not assure 100 % freedom from non-conforming product.

9. Test Methods

9.1 Tests shall be conducted in accordance with Test Methods F606/F606M.

10. Test Report

10.1 When specified on the inquiry and purchase order, the manufacturer or supplier, whichever is the responsible party, as defined in Section 14, shall furnish the purchaser a test report that includes the following, as applicable.

10.2 Information:

10.2.1 Lot number.

10.2.2 Purchase order number, job number, sequence number, or other special identifiers if specified.

10.2.3 Mailing address of responsible party.

10.2.4 Title and signature of the individual assigned test report responsibility.

10.2.5 Date and ASTM standard, including revision number.

10.3 Results—Report results of all required tests.

10.3.1 Heat analysis, heat number, and calculated Corrosion Index for Type 3 material if not from Composition A or B.

10.3.2 Results of hardness and proof load tests.

10.3.3 Results of coating thickness for coated nuts; if required.

10.3.4 Results of inspection for surface discontinuities.

10.4 Statements:

10.4.1 Statement of conformance with dimensional and thread fit requirements.

10.4.2 Statement certifying that steel heats having the elements listed in 5.5 intentionally added were not used.

11. Other Quality Assurance Requirements

11.1 Workmanship:

11.1.1 The allowable limits, inspection, and evaluation of surface discontinuities shall be in accordance with Specification **F812**.

11.2 *Special Inspection:*

11.2.1 If observation or inspection is required by the purchaser, it shall be specified in the inquiry and order. Such observation or inspection requirements shall be specified and agreed upon by all parties.

11.2.2 The purchaser's representative shall have free entry to all parts of the manufacturer's or subcontractor's works, or supplier's place of business that concern the manufacture or supply of the material ordered.

11.2.3 The manufacturer or supplier shall afford the purchaser's representative all reasonable facilities to satisfy them that the material is being furnished in accordance with this specification.

11.2.4 All tests and inspections required by the purchaser's representative shall be made before shipment, and conducted so as not to interfere unnecessarily with the operation.

11.3 *Rejection and Rehearing:*

11.3.1 Disposition of nonconforming nuts shall be in accordance with Practice **F1470** section titled "Disposition of Nonconforming Lots".

12. Product Marking

12.1 Nuts made to the requirements of Grades 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.

12.2 Heavy hex nuts made to the requirements of Grade C (**Note 5**) shall be marked on one face with three circumferential marks 120° apart.

12.3 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.

12.4 Nuts made to the requirements of Grade D shall be marked with the grade symbol, D (**Note 5**) on one face.

12.5 Nuts made to the requirements of Grade DH shall be marked with the grade symbol, DH (**Note 5**) on one face.

12.6 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.

12.7 Heavy hex nuts made to the requirements of Grade 8S shall be marked with the grade symbol, 8S (**Note 5**) on one face.

12.8 Heavy hex nuts made to the requirements of Grade 8S3 shall be marked with the grade symbol 8S3 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.

12.9 Heavy hex nuts made to the requirements of Grade 10S shall be marked with the grade symbol, 10S (**Note 5**) on one face.

12.10 Heavy hex nuts made to the requirements of Grade 10S3 shall be marked with the grade symbol 10S3 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.

12.11 In addition, nuts of Grades C, C3, D, DH, DH3, 8S, 8S3, 10S, and 10S3 shall be marked with a symbol to identify the manufacturer or private label distributor, as appropriate.

12.12 Marks may be raised or depressed at the option of the manufacturer. However, for nuts that do not have a washer face, markings shall be depressed. For nuts with a washer face, markings shall be located on the opposite side of the washer face.

12.13 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 5—See **Table 2** for marking of equivalent nuts made in accordance with requirements of Specification **A194/A194M**.

13. Packaging and Package Marking

13.1 *Packaging:*

13.1.1 Unless otherwise specified, packaging shall be in accordance with the manufacturers practice to prevent damage before and during shipment.

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

13.2 *Package Marking:*

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

13.2.1.1 ASTM designation and grade,

13.2.1.2 Size,

13.2.1.3 Name and brand or trademark of the manufacturer,

13.2.1.4 Number of pieces,

13.2.1.5 Purchase order number, and

13.2.1.6 Country of origin.

14. Responsibility

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

15. Keywords

15.1 alloy steel; carbon steel; nuts; steel; weathering steel