Designation: ~~F836M – 16ε1~~ F836M – 20

Standard Specification for Style 1 Stainless Steel Metric Nuts (Metric)[1]

This standard is issued under the fixed designation F836M; 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.

~~ε[1] NOTE—Table 3 was editorially corrected in January 2018.~~

1. Scope*

1.1 This specification covers the chemical and mechanical requirements for stainless steel metric nuts with nominal thread diameters M1.6 through M36 and intended for use in engineering applications requiring general corrosion resistance.

1.2 Eight groups of stainless steel alloys are covered, including three austenitic (Grades A1, A2, and A4), one ferritic (Grade F1), three martensitic (Grades C1, C3, and C4), and one precipitation hardening (Grade P1).

1.3 Seventeen property classes are covered, including nine austenitic, one ferritic, six martensitic, and one precipitation hardening. The property classes with the permissible alloys for each are listed in Table 1.

1.4 This specification is based in concept and content on ISO 3506. The chemical and mechanical requirements specified for all property classes, except as given in 1.4.1, are essentially identical with classes of the same designation in ISO 3506.

1.4.1 This specification includes 13 of the 16 property classes covered in ISO 3506. Additionally, it includes property classes A1-70, A2–70, A4–70, A1–80, A2–80, and A4–80 for products with nominal thread diameters larger than M20; and four non-ISO property classes, C1-110, C4-110, C3-120, and P1-90.

1.5 Supplementary requirements of an optional nature are provided, applicable only when agreed upon between the manufacturer and the purchaser at the time of the inquiry and order.

1.6 Suitable bolts, hex cap screws, and studs for use with nuts included in this specification are covered by Specification F738M. Unless otherwise specified, all bolts, hex cap screws, and studs used with these nuts shall conform to the requirements of Specification F738M and shall be of the same alloy group.

1.7 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

1.8 *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:*[2]

A262 Practices for Detecting Susceptibility to Intergranular Attack in Austenitic Stainless Steels
A342/A342M Test Methods for Permeability of Weakly Magnetic Materials
A380 Practice for Cleaning, Descaling, and Passivation of Stainless Steel Parts, Equipment, and Systems
A493 Specification for Stainless Steel Wire and Wire Rods for Cold Heading and Cold Forging
A555/A555M Specification for General Requirements for Stainless Steel Wire and Wire Rods
A564/A564M Specification for Hot-Rolled and Cold-Finished Age-Hardening Stainless Steel Bars and Shapes
A582/A582M Specification for Free-Machining Stainless Steel Bars
A751 Test Methods, Practices, and Terminology for Chemical Analysis of Steel Products
D3951 Practice for Commercial Packaging
E29 Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications

[1] This specification is under the jurisdiction of ASTM Committee F16 on Fastenersand is the direct responsibility of Subcommittee F16.04 on Nonferrous Fasteners.
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[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.

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

TABLE 1 Property Classes of Stainless Steel Nuts

Property Class	Permissible Alloys
A1-50 A1-70 A1-80	304, 304L, 305[A] 384, 18–9LW, 302HQ
A2-50 A2-70 A2-80	321, 347
A4-50 A4-70 A4-80	316, 316L
F1-45	430[B]
C1-70 C1-110	410
C3-80 C3-120	431
C4-70 C4-110	416, 416Se
P1-90	630

[A] When approved by the purchaser, Alloys 303, 303Se, or XM1 may be furnished.
[B] When approved by the purchaser, Alloy 430F may be furnished.

F606M Test Methods for Determining the Mechanical Properties of Externally and Internally Threaded Fasteners, Washers, and Rivets (Metric)
F738M Specification for Stainless Steel Metric Bolts, Screws, and Studs (Withdrawn 2014)[3]
F1470 Practice for Fastener Sampling for Specified Mechanical Properties and Performance Inspection

2.2 *ISO Standard:*[4]
ISO 3506 Corrosion-Resistant Stainless Steel Fasteners
ISO 4032 Hexagon regular nuts (style 1)—Product grades A and B

2.3 *ASME Standards:*
ASME B1.13M Metric Screw Threads—M Profile[4]
ASME B18.2.4.4M Metric Hex Flange Nuts

NOTE 1—The following ASTM standards are noted for information only as suitable sources of material for the manufacture of nuts to this specification: Specifications A493, A564/A564M, and A582/A582M.

3. Classification

3.1 The designation of each property class is comprised of three parts, a letter followed by a single digit, followed by either two or three digits (see Table 1).

3.1.1 The letter indicates the general composition type of stainless steel:

3.1.1.1 *A* for austenitic steels,

3.1.1.2 *F* for ferritic steels,

3.1.1.3 *C* for martensitic steels, and

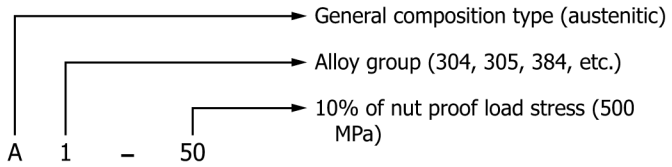
3.1.1.4 *P* for precipitation-hardening steel.

3.1.2 The first digit (1, 2, 3, or 4) indicates the alloy group. The permissible alloys within each group are given in Table 1.

3.1.3 The last two or three digits (50, 70, 110, etc.) indicate 10 % of the specified nut proof load stress of the property class.

3.1.4 For example, Class A1-50 is an austenitic steel of any one of six permitted alloys, and the manufactured nut has a proof load stress of 500 MPa.

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



4. Ordering Information

4.1 Orders for nuts under this specification shall include the following :
4.1.1 Quantity (number of pieces of each item);
4.1.2 Name of item (specific type and style, and references to dimensional standard when appropriate);
4.1.3 Size (nominal diameter, thread pitch);
4.1.4 Property class;
4.1.5 Supplementary requirements, if any (S1 through S3).
4.1.6 Orders for nuts under this specification may include the following optional requirements:
4.1.6.1 Forming (5.1);
4.1.6.2 Alloy condition (5.2);
4.1.6.3 Alloy selection (7.2.1 and S2);
4.1.6.4 Test report (15.2);
4.1.6.5 Additional testing (11.3);
4.1.6.6 Corrosion resistance testing (11.2);
4.1.6.7 Inspection (13.1);
4.1.6.8 Heat number (11.1.1);
4.1.6.9 Certification (15.1);
4.1.6.10 Proof load testing (9.2).
4.1.7 ASTM specification and date of issue. When date of issue is not specified, nuts shall be furnished to the latest issue.

NOTE 2—Example:
10 000 pieces, hex nut, ISO 4032, M6 × 1, Class A2-70, furnish test report, ASTM F836M – XX.
15 000 pieces, Hex Flange Nuts, ASME B18.2.4.4M, M8 × 1.25, class A4-50, Supplementary Requirement S3, ASTM F836 – XX.

5. Materials and Manufacture

5.1 *Forming*—Unless otherwise specified, nuts shall be cold-formed, hot-formed, or machined, at the option of the manufacturer.

5.2 *Condition*—Nuts shall be furnished in the condition specified for the property class in Table 2. If other conditions are required, the condition and resultant mechanical properties shall be as agreed upon between the manufacturer and the purchaser.

5.3 *Surface Finish*—Unless otherwise specified, nuts shall be cleaned and descaled in accordance with Practice A380.

6. Heat Treatment

6.1 *Austenitic Alloys, Grades A1, A2, and A4:*
6.1.1 When Condition A is specified, the nuts shall be machined from annealed or solution annealed stock, thus retaining the properties of the original material, or hot formed and solution annealed.
6.1.2 When Condition AF is specified, the nuts, following manufacture, shall be annealed by heating to 1040 ± 30°C, at which time the chromium carbide will go into solution. The nuts shall be held for a sufficient time and then cooled at a rate sufficient to prevent precipitation of the carbide and to provide the properties specified in Table 2.
6.1.3 When Condition CW is specified, the austenitic alloy shall be annealed as specified in 6.1.1, and then cold-worked to develop the properties specified in Table 2.
6.1.4 When Condition SH is specified, nuts shall be machined from strain hardened stock.

6.2 *Ferritic Alloys, Grade F1:*
6.2.1 When Condition A is specified, the ferritic alloy shall be heated to a temperature of 790 ± 30°C, held for an appropriate time, and then air-cooled to provide the properties specified in Table 2.
6.2.2 When Condition AF is specified, nuts shall be treated as specified in 6.1.2.

6.3 *Martensitic Alloys, Grades C1, C3, and C4:*
6.3.1 When Condition H is specified, the nuts shall be hardened and tempered by heating to 1010 ± 30°C sufficient for austenitization, holding for at least 1 h and then air-cooling to provide the properties specified in Table 2.
6.3.2 When Condition HT is specified, the nuts shall be hardened and tempered by heating to 1010 ± 30°C sufficient for austenitization, holding for at least ½ h, rapid air- or oil-quenching, reheating to 275°C minimum, and holding for at least 1 h and then air-cooling to provide the properties specified in Table 2.

TABLE 2 Mechanical Property Requirements

Property Class	Condition[A]	Alloy/Mechanical Property Marking	Nominal Thread Diameter	Proof Load Stress, MPa	Hardness			
					Vickers		Rockwell	
					min	max	min	max
A1-50 A2-50 A4-50	A or AF	F836A F836B F836C	M1.6 to M36	500	155	220	B81	B95
A1-70 A2-70 A4-70	CW	F836D F836E F836F	M1.6 to M20 over M20 to M36	700 550	220 160	330 310	B96 B83	C33 C31
A1-80 A2-80 A4-80	SH	F836G F836H F836J	M1.6 to M20 over M20 to M24 over M24 to M30 over M30 to M36	800 700 650 600	240 220 200 180	350 330 310 285	C23 B96 B93 B89	C36 C33 C30 C28
F1-45	A or AF	F836K	M1.6 to M36	450	135	220	B74	B96
C1-70 C4-70	H	F836L F836M	M1.6 to M36	700	220	330	B96	C34
C1-110 C4-110	HT	F836N F836P	M1.6 to M36	1100	350	440	C36	C45
C3-80	H	F836R	M1.6 to M36	800	240	340	C23	C35
C3-120	HT	F836S	M1.6 to M36	1200	380	480	C39	C48
P1-90	AH	F836T	M1.6 to M36	900	285	370	C28	C38

[A] *Legend of Conditions:*
AF—formed and annealed.
CW—formed from annealed stock, thus acquiring a degree of cold work.
SH—machined from strain hardened stock.
A—machined from annealed or solution annealed stock, thus retaining the properties of the original material, or hot formed and solution annealed.
H—hardened and tempered at 565°C medium.
HT—hardened and tempered at 275°C minimum.
AH—solution annealed and age hardened after forming.

6.4 *Precipitation-Hardening Alloy, Grade P1*—When Condition AH is specified, the nuts shall be solution-annealed and aged by heating to 1040 ± 15°C, holding for at least ½ h, rapid air- or oil-quenching to 27°C maximum, reheating to 620 ± 10°C minimum, holding for 4 h, and then air-cooling to provide the properties specified in Table 2.

7. Chemical Composition

7.1 It is the intent of this specification that nuts shall be ordered by property class.

7.2 Unless otherwise specified in the inquiry and purchase order (see Supplementary Requirement S2), when two or more alloys are permitted for nuts of a specified property class, the choice of alloy to be used shall be that of the fastener manufacturer as determined by his nut fabrication methods and material availability. The specific alloy used by the manufacturer shall be identified clearly on any certification required in the purchase order and shall have a chemical composition conforming to the limits specified in Table 3.

7.2.1 When the purchaser specifies that a specific alloy be used, the alloy shall have a chemical composition conforming to the limits specified in Table 3.

7.3 Product analysis may be made by the purchaser from nuts representing each lot. The chemical composition thus determined shall conform to the limits specified in Table 3 for the specific alloy within the product analysis tolerances specified in Specification A555/A555M.

7.3.1 In the event of discrepancy, a referee analysis of samples for each lot shall be made in accordance with 12.1.

8. Corrosion Resistance

8.1 *Carbide Precipitation:*

8.1.1 Rod, bar, and wire in the austenitic Alloy Groups A1, A2, and A4, except the free-machining grades, 303 and 303Se, used to make nuts in accordance with this specification, shall be capable of passing the test for susceptibility to intergranular corrosion as specified in Practice E of Practices A262.

TABLE 3 Chemical Requirements

Alloy Group	Alloy	UNS Designation	Composition, % maximum except as shown, ellipses indicate no requirement for listed element									
			Carbon	Manganese	Phosphorus	Sulfur	Silicon	Chromium	Nickel	Copper	Molybdenum	Others
						Austenitic Alloys						
~~A1~~	~~303~~	~~S30300~~	~~0.15~~	~~2.00~~	~~0.20~~	~~0.15 min~~	~~1.00~~	~~17.0 to 19.0~~	~~8.0 to 10.0~~		~~0.60max[A]~~	
A1	303	S30300	0.15	2.00	0.20	0.15 min	1.00	17.0 to 19.0	8.0 to 10.0	...	0.60[A]	...
A1	303Se	S30323	0.15	2.00	0.20	0.060	1.00	17.0 to 19.0	8.0 to 10.0	...	...	Se 0.15 min
~~A1~~	~~304~~	~~S30400~~	~~0.08~~	~~2.00~~	~~0.045~~	~~0.030~~	~~1.00~~	~~18.0 to 20.0~~	~~8.0 to 10.5~~	~~1.00~~		
A1	304	S30400	0.08	2.00	0.045	0.030	1.00	18.0 to 20.0	8.0 to 10.5	–[B]	...	...
~~A1~~	~~304L~~	~~S30403~~	~~0.03~~	~~2.00~~	~~0.045~~	~~0.030~~	~~1.00~~	~~18.0 to 20.0~~	~~8.0 to 12.0~~	~~1.00~~		
A1	304L	S30403	0.03	2.00	0.045	0.030	1.00	18.0 to 20.0	8.0 to 12.0	–[B]	...	...
~~A1~~	~~305~~	~~S30500~~	~~0.12~~	~~2.00~~	~~0.045~~	~~0.030~~	~~1.00~~	~~17.0 to 19.0~~	~~10.5 to 13.0~~	~~1.00~~		
A1	305	S30500	0.12	2.00	0.045	0.030	1.00	17.0 to 19.0	10.0 to 13.0	–[B]	...	...
A1	384	S38400	0.08	2.00	0.045	0.030	1.00	15.0 to 17.0	17.0 to 19.0	...	...	...
~~A1~~	~~XM1~~	~~S20300~~	~~0.08~~	~~5.0 to 6.5~~	~~0.040~~	~~0.18 to 0.35~~	~~1.00~~	~~16.0 to 18.0~~	~~5.0 to 6.5~~	~~1.75 to 2.25~~	~~0.50max[A]~~	
A1	XM1	S20300	0.08	5.0 to 6.5	0.040	0.18 to 0.35	1.00	16.0 to 18.0	5.0 to 6.5	1.75 to 2.25	0.50[A]	...
A1	18–9LW	S30430	0.10	2.00	0.045	0.030	1.00	17.0 to 19.0	8.0 to 10.0	3.0 to 4.0	...	...
A1	302HQ	S30433	0.03	2.00	0.045	0.030	1.00	17.0 to 19.0	8.0 to 10.0	3.0 to 4.0	...	...
A4	316	S31600	0.08	2.00	0.045	0.030	1.00	16.0 to 18.0	10.0 to 14.0	...	2.00–3.00	...
A4	316L	S31603	0.03	2.00	0.045	0.030	1.00	16.0 to 18.0	10.0 to 14.0	...	2.00–3.00	...
~~A2[†]~~	~~321~~	~~S32100~~	~~0.08~~	~~2.00~~	~~0.045~~	~~0.030~~	~~1.00~~	~~17.0 to 19.0~~	~~9.0 to 12.0~~			~~Ti 5 × C min~~
A2	321	S32100	0.08	2.00	0.045	0.030	1.00	17.0 to 19.0	9.0 to 12.0	...	...	Ti 5 × C min
~~A2~~	~~347~~	~~S34700~~	~~0.08~~	~~2.00~~	~~0.045~~	~~0.030~~	~~1.00~~	~~17.0 to 19.0~~	~~9.0 to 13.0~~			~~Cb + Ta 10 × C min~~
A2	347	S34700	0.08	2.00	0.045	0.030	1.00	17.0 to 19.0	9.0 to 13.0	...	...	Nb 10 × C min[C]
						Ferritic Alloys						
F1	430	S43000	0.12	1.00	0.040	0.030	1.00	16.0 to 18.0	...	...	...	...
~~F1~~	~~430F~~	~~S43020~~	~~0.12~~	~~1.25~~	~~0.060~~	~~0.15 min~~	~~1.00~~	~~16.0 to 18.0~~			~~0.60max[A]~~	
F1	430F	S43020	0.12	1.25	0.060	0.15 min	1.00	16.0 to 18.0	...	...	0.60[A]	...
						Martensitic Alloys						
C1	410	S41000	0.15	1.00	0.040	0.030	1.00	11.5 to 13.5	...	...	...	...
~~C4~~	~~416 416Se~~	~~S41600~~	~~0.15~~	~~1.25~~	~~0.060~~	~~0.15 min~~	~~1.00~~	~~12.0 to 14.0~~			~~0.60max[A]~~	~~Se 0.15 min~~
C4	416	S41600	0.15	1.25	0.060	0.15 min	1.00	12.0 to 14.0	...	...	0.60[A]	...
C4	416Se	S41623	0.15	1.25	0.060	0.060 nom	1.00	12.0 to 14.0	...	...	...	Se 0.15 min
C3	431	S43100	0.20	1.00	0.040	0.030	1.00	15.0 to 17.0	1.25 to 2.50	...	...	...
						Precipitation Hardening Alloy						
~~P1~~	~~630~~	~~S17400~~	~~0.07~~	~~1.00~~	~~0.040~~	~~0.030~~	~~1.00~~	~~15.0 to 17.5~~	~~3.0 to 5.0~~	~~3.0 to 5.0~~		~~Cb + Ta 0.15–0.45~~
P1	630	S17400	0.07	1.00	0.040	0.030	1.00	15.0 to 17.5	3.0 to 5.0	3.0 to 5.0	...	Nb 0.15–0.45[C]

[A] At manufacturer's option, determined only when intentionally added.
[†] ~~Editorially corrected in January 2018.~~
[B] 1.00 % Cu max allowed by this standard for formability at manufacturer's option.
[C] Niobium formerly known as Colombium (Cb).

8.1.2 As stated in Practices A262, samples may be subjected to the faster and more severe screening test in accordance with Practice A. Failing Practice A, specimens may be tested in accordance with Practice E and be considered satisfactory if passing Practice E.

9. Mechanical Properties

9.1 The hardness of nuts of each class shall not exceed the maximum hardness specified for the class in Table 2. This shall be the only hardness requirement for nuts that are proof load tested.