



Designation: F 467 – 06a

Standard Specification for Nonferrous Nuts for General Use¹

This standard is issued under the fixed designation F 467; 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 approval. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reapproval.

This standard has been approved for use by agencies of the Department of Defense.

1. Scope*

1.1 This specification covers the requirements for commercial wrought nonferrous nuts 0.250 to 1.500 in. inclusive in diameter in a number of alloys in common use and intended for general service applications.

1.2 Applicable bolts, cap screws, and studs for use with nuts covered by this specification are covered by Specification F 468.

NOTE 1—A complete metric companion to Specification F 467 has been developed—F 467M; therefore no metric equivalents are presented in this specification.

2. Referenced Documents

2.1 ASTM Standards:²

- B 154 Test Method for Mercurous Nitrate Test for Copper Alloys
- B 574 Specification for Low-Carbon Nickel-Chromium-Molybdenum, Low-Carbon Nickel-Molybdenum-Chromium-Tantalum, Low-Carbon Nickel-Chromium-Molybdenum-Copper, and Low-Carbon Nickel-Chromium-Molybdenum-Tungsten Alloy Rod
- D 3951 Practice for Commercial Packaging
- E 18 Test Methods for Rockwell Hardness and Rockwell Superficial Hardness of Metallic Materials
- E 29 Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications
- E 34 Test Methods for Chemical Analysis of Aluminum and Aluminum-Base Alloys
- E 38 Methods for Chemical Analysis of Nickel-Chromium and Nickel-Chromium-Iron Alloys³
- E 53 Test Method for Determination of Copper in Unalloyed Copper by Gravimetry

- E 54 Test Methods for Chemical Analysis of Special Brasses and Bronzes³
- E 55 Practice for Sampling Wrought Nonferrous Metals and Alloys for Determination of Chemical Composition
- E 62 Test Methods for Chemical Analysis of Copper and Copper Alloys (Photometric Methods)
- E 75 Test Methods for Chemical Analysis of Copper-Nickel and Copper-Nickel-Zinc Alloys
- E 76 Test Methods for Chemical Analysis of Nickel-Copper Alloys³
- E 92 Test Method for Vickers Hardness of Metallic Materials
- E 101 Test Method for Spectrographic Analysis of Aluminum and Aluminum Alloys by the Point-To-Plane Technique³
- E 120 Test Methods for Chemical Analysis of Titanium and Titanium Alloys³
- E 165 Test Method for Liquid Penetrant Examination
- E 227 Test Method for Optical Emission Spectrometric Analysis of Aluminum and Aluminum Alloys by the Point-to-Plane Technique³
- E 354 Test Methods for Chemical Analysis of High-Temperature, Electrical, Magnetic, and Other Similar Iron, Nickel, and Cobalt Alloys
- E 478 Test Methods for Chemical Analysis of Copper Alloys
- E 1409 Test Method for Determination of Oxygen and Nitrogen in Titanium and Titanium Alloys by the Inert Gas Fusion Technique
- F 468 Specification for Nonferrous Bolts, Hex Cap Screws, and Studs for General Use
- F 606 Test Methods for Determining the Mechanical Properties of Externally and Internally Threaded Fasteners, Washers, and Rivets
- F 1470 Guide for Fastener Sampling for Specified Mechanical Properties and Performance Inspection

2.2 ASME Standards:⁴

- B 1.1 Unified Inch Screw Threads (UN and UNR Thread Form)

¹ This specification is under the jurisdiction of ASTM Committee F16 on Fasteners and 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.

³ Withdrawn.

⁴ Available from Global Engineering Documents, 15 Inverness Way, East Englewood, CO 80112-5704, <http://global.ihs.com>.

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

B 18.2.2 Square and Hex Nuts

3. Ordering Information

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

- 3.1.1 Quantity (number of pieces of each item and size);
- 3.1.2 Name of item;
- 3.1.3 Size (diameter and threads per inch);
- 3.1.4 Alloy number (Table 1);
- 3.1.5 Stress relieving, if required (4.2.3);
- 3.1.6 “Shipment lot” testing, as required (Section 9);
- 3.1.7 Source inspection, if required (Section 14);
- 3.1.8 Certificate of compliance or test report, if required (Section 16);
- 3.1.9 Additional requirements, if any, to be specified on the purchase order (4.2.1, 7.2, 8.2, 12.1, and 13.1),
- 3.1.10 Supplementary requirements, if any; and
- 3.1.11 ASTM designation (including year or published date).

NOTE 2—A typical ordering description is as follows: 10 000 pieces, Hex Nut, 0.250" -20, Alloy 270, Furnish Certificate of Compliance, Supplementary Requirement S 1, ASTM Specification F 467-XX

4. Materials and Manufacture

4.1 Materials:

4.1.1 The nuts shall be manufactured from material having a chemical composition conforming to the requirements in Table 2 and capable of developing the required mechanical properties for the specified alloy in the finished fastener. See Specification B 574 for nickel alloys.

4.1.2 The starting condition of the raw material shall be at the discretion of the fastener manufacturer but shall be such that the finished products conform to all the specified requirements.

4.2 Manufacture:

4.2.1 *Forming*—Unless otherwise specified, the nuts shall be hot pressed, cold formed, or machined from suitable material at the option of the manufacturer.

4.2.2 *Condition*—Except as provided in 4.2.3, the nuts shall be furnished in the condition specified below:

Alloy	Condition
Copper (all alloys)	As formed or stress relieved at manufacturer's option
Nickel alloys 400 and 405	As formed or stress relieved at manufacturer's option
Nickel alloy 500	Solution annealed and aged
Aluminum alloys:	
2024-T4	Solution treated and naturally aged
6061-T6	Solution treated and artificially aged
6262-T9	Solution treated, artificially aged, and cold worked
Titanium	As formed
625	Annealed

4.2.3 *Stress Relieving*—When required, stress relieving shall be specified by the purchaser for all copper alloys and nickel alloys 400 and 405.

5. Chemical Composition

5.1 *Chemical Composition*—The nuts shall conform to the chemical composition specified in Table 1 for the specified alloy.

5.2 Manufacturer's Analysis:

5.2.1 Except as provided in 5.2.2, when test reports are required on the inquiry or purchase order (3.1.8), the manufacturer shall make individual analyses of randomly selected finished nuts from the product to be shipped and report the results to the purchaser. Alternatively, if heat and lot identities have been maintained, the analysis of the raw material from which the nuts have been manufactured may be reported instead of product analysis.

5.2.2 For aluminum nuts, instead of 5.2.1, the manufacturer may furnish a certificate of conformance certifying compliance with the chemical composition specified in Table 1.

5.3 Product Analysis:

5.3.1 Product analyses may be made by the purchaser from finished products representing each lot. The chemical composition thus determined shall conform to the requirements in Table 1.

5.3.2 In the event of disagreement, a referee chemical analysis of samples from each lot shall be made in accordance with 12.1 and 13.1.

6. Mechanical Properties

6.1 The nuts shall be tested in accordance with the mechanical testing requirements for the applicable type and shall meet the mechanical requirements in Table 2 for the specified alloy.

6.2 Where both proof load and hardness tests are performed, the proof load test results shall take precedence for acceptance purposes.

7. Dimensions

7.1 *Nuts*—Unless otherwise specified, the dimensions of nuts shall be in accordance with the requirements of ASME B8.2.2.

7.2 *Threads*—Unless otherwise specified, the nuts shall have Class 6H threads in accordance with ASME B 1.1.

8. Workmanship, Finish, and Appearance

8.1 *Workmanship*—Nuts shall have a workmanlike finish free of injurious burrs, seams, laps, irregular surfaces, and other imperfections affecting serviceability.

8.2 *Finish*—Unless otherwise specified, the nuts shall be furnished without any additive chemical or metallic finish.

9. Sampling

9.1 A lot, for the purposes of selecting test specimens, shall consist of not more than 100 000 pieces offered for inspection at one time having the following common characteristics:

- 9.1.1 One type of item,
- 9.1.2 Same alloy and temper, and
- 9.1.3 One nominal diameter and thread series.

10. Number of Tests and Retests

10.1 *Normal Testing*—The requirements of this specification shall be met in continuous mass production for stock (see Table 3). The manufacturer shall make sample inspections as specified below to ensure that the product conforms to the specified requirements. When tests of individual shipments are

required, Supplementary Requirement S 2 shall be specified.

Number of Pieces in Lot	Acceptance Criteria		
	No. of Tests	Acceptance No.	Rejection No.
50 and under	2	0	1
51 to 500	3	0	1
501 to 35 000	5	0	1
35 001 to 100 000	8	0	1

10.2 Retests:

10.2.1 When tested in accordance with the required sampling plan, a lot shall be subject to rejection if any of the test specimens fails to meet the applicable test requirements.

10.2.2 If the failure of a test specimen is due to improper preparation of the specimen or to incorrect testing technique, the specimen shall be discarded and another specimen substituted.

11. Significance of Numerical Limits

11.1 For purposes of determining compliance with the specified limits for requirements of the properties listed in this specification, an observed value or calculated value shall be rounded in accordance with Practice E 29.

12. Test Specimens

12.1 *Chemical Tests*—When required, samples for chemical analysis shall be taken in accordance with Practice E 55 by drilling, sawing, milling, turning, clipping, or such other methods capable of producing representative samples.

12.2 Mechanical Tests:

12.2.1 Nuts shall be tested in full section.

12.2.2 The hardness shall be determined on the top or bottom face of the nut.

13. Test Methods

13.1 *Chemical Analysis*—When required, the chemical composition shall be determined by any recognized commercial test method. In the event of disagreement, the following test methods shall be used for referee purposes.

Alloy	Test Method
Copper	E 53, E 54, E 62, E 75, E 478
Aluminum	E 34, E 101, 8a E 227
Nickel	E 38, E 76, E 354
Titanium	E 120, E 1409

13.2 Mechanical:

13.2.1 The proof load or proof stress tests shall be determined in accordance with the appropriate methods of Test Methods F 606. Loads to be determined using Table 2 and Table 4.

13.2.2 The hardness shall be determined in accordance with Test Methods E 18 and E 92. For sizes ¼ (0.250) to ⅞ (0.4375) in. one reading shall be taken. For sizes ½ (0.500) in. and larger the hardness shall be the average of four readings located 90° to one another.

14. Inspection

14.1 When specified on the inquiry or purchase order, the product shall be subject to inspection by the purchaser at the

place of manufacture prior to shipment. The inspector representing the purchaser shall have controlled entry only to those parts of the manufacturer's operations that concern the manufacture of the ordered product and only when and where work on the contract of the purchaser is being performed. The manufacturer shall afford the inspector all reasonable facilities to satisfy him that the product is being furnished in accordance with this specification. All inspections and tests shall be conducted so as not to interfere unnecessarily with the operations of the manufacturer.

15. Rejection and Rehearing

15.1 Unless otherwise specified, any rejection based on tests specified herein and made by the purchaser shall be reported to the manufacturer as soon as practical after receipt of the product by the purchaser.

16. Certification and Test Reports

16.1 *Certificate of Compliance*—When specified in the contract or purchase order, the manufacturer shall furnish certification that the product was manufactured and tested in accordance with this specification and conforms to all specified requirements.

16.2 *Test Reports*—When “Shipment Lot Testing” in accordance with Supplementary Requirement S2 is specified in the contract or purchase order, the manufacturer shall furnish a test report showing the results of the mechanical tests for each lot shipped.

17. Product, Packaging and Package Marking

17.1 *Individual Nuts*—All products shall be marked with a symbol identifying the manufacturer. In addition, they shall be marked with the alloy/mechanical property marking specified in Table 1. The marking shall be raised or depressed at the option of the manufacturer.

17.2 Packaging:

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

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

17.3 *Package Marking*—Each shipping unit shall include or be plainly marked with the following:

- 17.3.1 ASTM designation,
- 17.3.2 Alloy number,
- 17.3.3 Alloy/mechanical property marking,
- 17.3.4 Size,
- 17.3.5 Name and brand or trademark of the manufacturer,
- 17.3.6 Number of pieces,
- 17.3.7 Country of origin, and
- 17.3.8 Purchase order number.

18. Keywords

- 18.1 general use; nonferrous; nuts

SUPPLEMENTARY REQUIREMENTS

One or more of the following supplementary requirements shall be applied only when specified by the purchaser in the inquiry, contract, or order. Supplementary requirements shall in no way negate any requirement of the specification itself.

S1. Stress Corrosion Requirements, Copper Alloys

S1.1 Copper alloy fasteners shall exhibit no evidence of cracking after immersion for 30 min in an aqueous solution of mercurous nitrate when tested in accordance with Test Method **B 154**.

S1.1.1 **Warning**—Mercury is a definite health hazard and equipment for the detection and removal of mercury vapor produced in volatilization is recommended. The use of rubber gloves in testing is advisable.

S2. Shipment Lot Testing

S2.1 When Supplementary Requirement S2 is specified on the order (3.1.6), the manufacturer shall make sample tests on the individual lots for shipment to ensure that the product conforms to the specified requirements.

S2.2 The manufacturer shall make an analysis of a randomly selected finished nut from each lot of product to be shipped. Heat or lot control shall be maintained. The analysis of the starting material from which the nuts have been manufactured may be reported in place of the product analysis.

S2.3 The manufacturer shall perform mechanical property tests in accordance with this specification and Guide **F 1470** on the individual lots for shipment.

S2.4 The manufacturer shall furnish a test report for each lot in the shipment showing the actual results of the chemical analysis and mechanical property tests performed in accordance with Supplementary Requirement S2.

S3. Dye Penetrant Inspection

S3.1 When dye penetrant inspection is specified on the purchase order, the nuts shall be tested in accordance with Practice **E 165** or other mutually acceptable procedures and shall conform to acceptance criteria as mutually agreed upon between the purchaser and the manufacturer.

S4. Heat Control (Alloys 400, 405, and 500 Only)

S4.1 When Supplementary Requirement S4 is specified on the inquiry or order, the manufacturer shall control the product by heat analysis and identify the finished product in each shipment by the actual heat number.

S4.2 When Supplementary Requirement S4 is specified on the inquiry and order, Supplementary Requirement S2 shall be considered automatically invoked with the addition that the heat analysis shall be reported to the purchaser on the test reports.

SUMMARY OF CHANGES

Committee F16 has identified the location of selected changes to this standard since the last issue (F 467 – 06) that may impact the use of this standard. (Approved Aug. 1, 2006.)

(1) Revised proof stress for Ni 686 in **Table 2**.

Committee F16 has identified the location of selected changes to this standard since the last issue (F 467 – 05) that may impact the use of this standard. (Approved May 1, 2006.)

(1) Added new alloys UNS N06059 and UNS C26000 in **Table 1**.

(2) Added alloys Ni 59 and Cu 260 in **Table 2**.

TABLE 1 Chemical Requirements

Composition, %													
UNS Designation Number	Copper and Copper-Base Alloys												
	Alloy	General Name	Aluminum	Copper, min	Iron, max	Manganese, max	Nickel, max	Phosphorus	Silicon	Zinc, max ^A	Lead, max	Tin	Arsenic, max
C11000	110	ETP copper		99.9									
C26000	260	brass		68.5–71.5	0.05					balance	0.07		
C27000	270	brass		63.0–68.5	0.07					balance	0.10		
C46200	462	naval brass		62.0–65.0	0.10					balance	0.20	0.5–1.0	
C46400	464	naval brass		59.0–62.0	0.10					balance	0.20	0.5–1.0	
C51000	510	phosphor bronze		balance ^A	0.10			0.03–0.35		0.30	0.05	4.2–5.8	
C61300	613	aluminum bronze	6.0–7.5	^B	2.0–3.0	0.10	0.15 ^C	0.015	0.10	0.05	0.01	0.20–0.50	
C61400	614	aluminum bronze	6.0–8.0	88.0 ^D	1.5–3.5	1.0							
C63000	630	aluminum bronze	9.0–11.0	78.0 ^D	2.0–4.0	1.5	4.0–5.5		0.25 max			0.20 max	
C64200	642	aluminum silicon bronze	6.3–7.6	88.65 ^D	0.30	0.10	0.25		1.5–2.2 ^E	0.50	0.05	0.20 max	0.15
C65100	651	silicon bronze		96.0 ^D	0.8	0.7			0.8–2.0	1.5	0.05		
C65500	655	silicon bronze		94.8 ^D	0.8	1.5	0.6		2.8–3.8	1.5	0.05		
C66100	661	silicon bronze		94.0 ^D	0.25	1.5			2.8–3.5	1.5	0.20–0.8		
C67500	675	manganese bronze	0.25 max	57.0–60.0	0.8–2.0	0.05–0.5				balance	0.20	0.5–1.5	
C71000	710	cupro-nickel		74.0 ^D	0.60	1.00	19.0–23.0 ^C			1.00	0.05		
C71500	715	cupro-nickel		65.0 ^D	0.40–0.7	1.00	29.0–33.0 ^C			1.00	0.05		

^A Elements shown as balance shall be arithmetically computed by deducting the sum of the other named elements from 100.

^B Copper plus specified elements = 99.8 min; copper plus silver = 88.5–91.5.

^C Cobalt is to be counted as nickel.

^D Minimum content of copper plus all other elements with specified limits shall be 99.5 %.

^E An alloy containing as high as 2.6 % silicon is acceptable provided the sum of all the elements other than copper, silicon, and iron does not exceed 0.30 %.

TABLE 1 Continued

Nickel and Nickel-Base Alloys

UNS Designation Number	Alloy	General Name	Aluminum	Carbon, max	Chromium	Copper ^A	Iron, max	Manganese, max	Nickel ^A	Phosphorus, max	Silicon, max	Titanium	Cobalt, max	Molybdenum	Sulfur, max	Vanadium	Tungsten
N10001	335	Ni-Mo		0.05	1.0 max		4.0-6.0	1.0	balance	0.025	1.00		2.50	26.0-30.0	0.030	0.2-0.4	
N10276	276	Ni-Mo-Cr		0.02	14.5-16.5		4.0-7.0	1.00	balance	0.040	0.08		2.50	15.0-17.0	0.030	0.35 max	3.0-4.5
N04400	400	Ni-Cu Class A		0.3		balance	2.5	2.0	63.0-70.0		0.5		^B		0.024		
N04405	405	Ni-Cu Class B		0.3		balance	2.5	2.0	63.0-70.0		0.5		^B		0.025-0.060		
N05500	500	Ni-Cu-Al	2.30-3.15	0.25		balance	2.0	1.5	63.0-70.0		0.5	0.35-0.85	^B		0.01		
N06059	59	Ni-Cr-Mo	0.1-0.4	0.010 max	22.0-24.0	0.5 max	1.5 max	0.5 max	balance	0.015 max	0.10 max		0.3 max	15.0-16.5	0.010 max		
N06625	625 ^C	Ni-Cr-Mo-Cb	0.40 max	0.010	20.0-23.0		5.0 max	0.50 max	58.0 min	0.015	0.50 max	0.40 max	1.00 max	8.0-10.0	0.015		3.2-4.2
N06686	686	Ni-Cr-Mo-W		0.010 max	19.0-23.0		5.0 max	0.75 max	balance	0.04 max	0.08 max	0.02-0.25		15.0-17.0	0.02 max		3.0-4.4

^A Elements shown as balance shall be arithmetically computed by deducting the sum of the other named elements from 100.

^B Cobalt is to be counted as nickel.

^C Alloy 625 material shall be refined using the electroslag remelting process (ESR), or the vacuum arc remelting process (VAR).