



Designation: ~~F1586-02~~ Designation: F 1586 - 08

Standard Specification for ~~Wrought Nitrogen Strengthened 21 Chromium—10 Nickel— 3 Manganese—2.5 Molybdenum Stainless Steel Alloy Bar for Surgical Implants (UNS S31675)~~ Wrought Nitrogen Strengthened 21 Chromium—10 Nickel—3 Manganese— 2.5 Molybdenum Stainless Steel Alloy Bar for Surgical Implants (UNS S31675)¹

This standard is issued under the fixed designation F 1586; 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.

1. Scope*

1.1 This specification covers the chemical, mechanical, and metallurgical requirements for wrought nitrogen strengthened 21 chromium—10 nickel—3 manganese—2.5 molybdenum stainless steel alloy bar for surgical implants.

~~1.2 The values stated in inch-pound units are to be regarded as the standard. The SI equivalents of the inch-pound units may be approximate.~~

1.2 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

2. Referenced Documents

2.1 ASTM Standards:²

A 262 Practices for Detecting Susceptibility to Intergranular Attack in Austenitic Stainless Steels

A 484/A 484M Specification for General Requirements for Stainless Steel Bars, Billets, and Forgings

A 751 Test Methods, Practices, and Terminology for Chemical Analysis of Steel Products

E 8 Test Methods for Tension Testing of Metallic Materials

E 10 Test Method for Brinell Hardness of Metallic Materials

~~E 18 Test Methods for Rockwell Hardness and Rockwell Superficial Hardness of Metallic Materials⁴~~ Test Methods for Rockwell Hardness of Metallic Materials

E 29 Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications

E 45 Test Methods for Determining the Inclusion Content of Steel <http://www.astm.org/standards/E45>

E 112 Test Methods for Determining Average Grain Size⁴

~~E 354 Test Methods for Chemical Analysis of High-Temperature, Electrical, Magnetic, and Other Similar Iron, Nickel, and Cobalt Alloys~~ Test Methods for Determining Average Grain Size

F 138 Specification for Wrought 18 Chromium—14 Nickel—2.5 Molybdenum Stainless Steel Bar and Wire for Surgical Implants (UNS ~~S31673~~) S31673

F 746 Test Method for Pitting or Crevice Corrosion of Metallic Surgical Implant Materials

2.2 Aerospace Material Specifications:³

AMS 2248 Chemical Check Analysis Limits, Corrosion and Heat Resistant Steels and Alloys, Maraging and Other Highly-Alloyed Steels, and Iron Alloys

2.3 ASQC Standard:⁴

ASQ C1 Specification of General Requirements for a Quality Program

¹ This specification is under the jurisdiction of ASTM Committee F04 on Medical and Surgical Materials and Devices is under the direct responsibility of Subcommittee F04.12 on Metallurgical Materials.

~~Current edition approved Jan. 10, 2002. Published February 2002. Originally published as F1586-95. Last previous edition F1586-95.~~

~~Current edition approved May 1, 2008. Published May 2008. Originally approved in 1995. Last previous edition approved in 2002 as F 1586 - 02.~~

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*, Vol 01.03, volume information, refer to the standard's Document Summary page on the ASTM website.

³ Annual Book of ASTM Standards, Vol 01.05.

³ Available from Society of Automotive Engineers (SAE), 400 Commonwealth Dr., Warrendale, PA 15096-0001, <http://www.sae.org>.

⁴ Annual Book of ASTM Standards, Vol 03.01.

⁴ Available from American Society for Quality (ASQ), 600 N. Plankinton Ave., Milwaukee, WI 53203, <http://www.asq.org>.

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

2.4 *ISO Standard:*

~~ISO 6892 Metallic Materials Tensile Testing at Ambient Temperature~~⁵
 ISO 6892 Metallic Materials Tensile Testing at Ambient Temperature
 ISO 9001 Quality Management System—Requirements

3. General Requirements for Delivery

~~3.1~~In addition to the requirements of this specification, all requirements of the current edition of Specification A484 Terminology

3.1 Definitions of Terms Specific to This Standard:

3.1.1 lot, n—the total number of mill products produced from the same melt heat under the same conditions at essentially the same time.

4. General Requirements for Delivery

4.1 In addition to the requirements of this specification, all requirements of the current edition of Specification A 484 shall apply.

~~3.2~~4.2 In cases in which a conflict exists between this specification and the standards listed in Section 2, this specification shall take precedence.

4.5. Ordering Information

4.5.1 Inquiries and orders for material under this specification shall include the following information:

4.5.1.1 Quantity,

4.5.1.2 ASTM designation and date of issue,

4.5.1.3 Mechanical properties (if applicable, for special conditions),

4.5.1.4 Form,

4.5.1.5 Applicable dimensions including size, thickness, width, and length (exact, random, or multiples) or drawing number,

4.5.1.6 Condition (see 5.1.6.1),

4.1.7 Finish (see 5.2

5.1.7 Finish (see 6.2),

4.1.8 Special tests (if applicable), and

4.1.9 Other requirements.

5. Materials and Manufacture

5.1

5.1.8 Special tests (if any), and

5.1.9 Other requirements.

6. Materials and Manufacture

6.1 *Condition*—Bars shall be furnished in the annealed, medium hard, or hard condition, as specified.

5.2

6.2 *Finish*—Types of bar finishes available are cold-drawn, pickled, ground, ground and polished, or as specified by the purchaser.

6.7. Chemical Requirements

~~6.1~~7.1 The supplier's heat analysis shall conform to the chemical requirements prescribed in Table 1. The supplier shall not ship material that is outside the limits specified in Table 1.

6.7.1.1 Requirements for the major and minor elemental constituents are listed in Table 1. Also listed are important residual elements. Analysis for elements not listed in Table 1 is not required to verify compliance with this specification.

6.7.1.2 Methods and practices relating to chemical analysis required by this specification shall be in accordance with Test Methods, Practices, and Terminology A 751.

6.2

7.2 *Product Analysis*—The product analysis is either for the purpose of verifying the composition of a heat or manufacturing lot or to determine variations in the composition within the heat.

6.7.2.1 Acceptance or rejection of a heat or lot of material may be made by the purchaser on the basis of this product analysis.

6.7.2.2 Product analysis tolerances do not broaden the specified heat analysis requirements but cover variations between laboratories in the measurement of chemical content. Product analysis limits shall be as specified in Table 2.

⁶ Annual Book of ASTM Standards, Vol 03.05.

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

TABLE 1 Chemical Composition

Element	Composition, % (Mass/Mass)
Carbon	0.08 max
Manganese	2.00 to 4.25
Phosphorus	0.025 max
Sulfur	0.01 max
Silicon	0.75 max
Chromium	19.5 to 22.0
Nickel	9.0 to 11.0
Molybdenum	2.0 to 3.0
Nitrogen	0.25 to 0.50
Niobium	0.25 to 0.80
Copper	0.25 max
Iron	balance ^A

^AApproximately equal to the difference between 100 % and the sum percent of the other specified elements. The percent of iron required by difference is not required to be determined or certified.

TABLE 2 Product Analysis Tolerances^{A,B}

Element	Permissible Variation Under the Minimum Limit or Over or Over the Maximum Limit, % (Mass/Mass) ^B
Carbon	0.01
Manganese	0.05
Phosphorus	0.005
Sulfur	0.005
Silicon	0.05
Chromium	0.25
Nickel	0.15
Molybdenum	0.10
Nitrogen ^B	0.02 under minimum; 0.04 over maximum
Nitrogen ^C	0.02 under minimum; 0.04 over maximum
Niobium	0.05
Copper	0.03

^ASee Test Methods E 354.

^BRefer to AMS 2248 for chemical check analysis limits (except nitrogen).

^B For elements in which only a maximum percentage is indicated, the "under minimum limit" is not applicable.

^C The specified range for this element is not covered by AMS 2248 and permissible variation has been established through industrial practice.

<https://standards.iteh.ai/catalog/standards/sist/34581174-54f9-4acd-80f4-ab47c9b2f3e/astm-f1586-08>

7.8. Metallurgical Requirements

7.8.1 The material shall exhibit no free delta ferrite, chi, or sigma phases when it is examined metallographically at 100× magnification.

7.8.2 The microcleanliness of the material, steel, as determined by Test Methods E 45, Method A, except using Plate Ir, on representative billet or bar samples from the heat shall not exceed the following:

Inclusion Type	A (Sulfide)	B (Alumina)	C (Silicate)	D (Globular Oxide)
Thin	1.5	2.0	2.0	2.5
Heavy	1.5	1.5	1.5	1.5

8. Mechanical Requirements

8.1

9. Mechanical Requirements

9.1 Tensile Properties:

9.1.1 Tensile properties shall be determined in accordance with Test Methods E 8.

9.1.2 The mechanical properties of test specimens shall conform to the requirements specified in Table 3.

8.2

9.2 Hardness:

8.2.1 When desired, hardness limits may be specified by the purchaser. Hardness determinations shall be made on a product cross section, midway between the center and surface, if cross section is adequate.

8.2.2 Hardness values shall be determined in accordance with Test Method E10

9.2.1 Hardness values shall be determined in accordance with Test Method E 10 or Test Methods E 18.