Designation: F 90 – 01

Standard Specification for Wrought Cobalt-20Chromium-15Tungsten-10Nickel Alloy for Surgical Implant Applications (UNS R30605)[1]

This standard is issued under the fixed designation F 90; 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 requirements for wrought cobalt-20chromium-15tungsten-10nickel alloy used for surgical implants. The properties specified apply specifically to wrought bar, rod, wire, sheet, and strip, but do not apply to surgical fixation wire (see Specification F 1091).

1.2 The values stated in inch-pound units are to be regarded as the standard. The SI equivalents in parentheses are for information only.

2. Referenced Documents

2.1 *ASTM Standards:*

A 751 Test Methods, Practices, and Terminology for Chemical Analysis of Steel Products[2]

E 8 Test Methods for Tension Testing of Metallic Materials[3]

E 354 Test Methods for Chemical Analysis of High-Temperature, Electrical, Magnetic, and Other Similar Iron, Nickel, and Cobalt Alloys[4]

F 981 Practice for Assessment of Compatibility of Biomaterials for Surgical Implants with Respect to Effect of Materials in Muscle and Bone[5]

F 1091 Specification for Wrought Cobalt-Chromium Alloy Surgical Fixation Wire[5]

2.2 *Aerospace Material Specification:*

AMS 2269 Chemical Check Analysis Limits, Wrought Nickel Alloys and Cobalt Alloys[6]

AMS 5759 Cobalt Alloy, Corrosion and Heat Resistant Bars, Forgings, and Rings, 52Co – 20 Cr – 10Ni – 15W, Solution Heat Treated[6]

2.3 *ISO Standards*

ISO 5832-5 Wrought Cobalt-Chromium-Tungsten-Nickel Alloy[7]

ISO 6892 Metallic Materials Tensile Testing at Ambient Temperature[7]

2.4 *American Society for Quality (ASQ) Standard:*

C1 Specification of General Requirements for a Quality Program[8]

3. Ordering Information

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

3.1.1 Quantity,

3.1.2 ASTM designation and date of issue,

3.1.3 Mechanical properties (see Section 6),

3.1.4 Form (bar, rod, wire, sheet, strip),

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

3.1.6 Condition (see 4.1),

3.1.7 Finish (see 4.2),

3.1.8 Other requirements.

4. Materials and Manufacture

4.1 *Condition*—Bar, wire, sheet, and strip shall be furnished to the purchaser, as specified, in the annealed or cold-worked condition.

4.2 *Finish*:

4.2.1 Types of finish available for bar and wire are bright annealed, pickled, cold-drawn, ground, ground and polished, or as specified in the purchase order.

4.2.2 Types of finish available for sheet and strip are bright annealed, pickled, cold-rolled, polished, or as specified in the purchase order.

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

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[2] *Annual Book of ASTM Standards*, Vol 01.03.

[3] *Annual Book of ASTM Standards*, Vol 03.01.

[4] *Annual Book of ASTM Standards*, Vol 03.05.

[5] *Annual Book of ASTM Standards*, Vol 13.01.

[6] Available from Society of Automotive Engineers, Inc., 400 Commonwealth Dr., Warrendale, PA 15096–0001.

[7] Available from American National Standards Association, 25 W. 43rd St., 4th Floor, New York, NY 10036.

[8] Available from American Society for Quality, 600 N. Plankinton Ave., Milwaukee, WI 53203.

5. Chemical Requirements

5.1 The heat analysis shall conform to the chemical composition of Table 1. The supplier shall not ship material that is outside the limits specified in Table 1.

5.1.1 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.

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

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

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

5.3 For referee purposes, Test Methods E 354 shall be used.

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

TABLE 1 Chemical Requirements

Element	Composition, % (mass/mass)	
	min	max
Carbon	0.05	0.15
Manganese	1.00	2.00
Silicon	...	0.40
Phosphorus	...	0.040
Sulfur	...	0.030
Chromium	19.00	21.00
Nickel	9.00	11.00
Tungsten	14.00	16.00
Iron	...	3.00
Cobalt[A]	balance	balance

[A] Approximately equal to the difference between 100 % and the sum percentage of the other specified elements. The percentage of the cobalt difference is not required to be reported.

TABLE 2 Product Analysis Tolerances[A]

Element	Tolerance Under the Minimum Limit or Over the Maximum Limit[B]
Carbon	0.01
Manganese	0.04
Silicon	0.03
Phosphorous	0.005
Sulfur	0.005
Chromium	0.25
Nickel	0.15 under min; 0.20 over max
Tungsten	0.25
Iron	0.07

[A] Refer to AMS 2269.

[B] Under minimum limit not applicable for elements where only a maximum percentage is indicated.

6. Mechanical Requirements

6.1 The material in the annealed condition shall conform to the mechanical properties specified in Tables 3 and 4.

6.2 The level of mechanical properties for material in other than the annealed condition shall be specified in the purchase order.

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

7. Certification

7.1 Certification shall be provided by the supplier that the material meets the requirements of this specification. A report of the test results shall be furnished at the time of shipment.

8. Quality Program Requirements

8.1 The alloy producer and any processors shall maintain a quality program, such as defined in ASQ C1.

9. Keywords

9.1 cobalt alloys (for surgical implants); cobalt chromium; L-605 alloy; metals (for surgical implants)—cobalt alloys