



Designation: ~~F799–11~~ **F799 – 19**

Standard Specification for ~~Cobalt-28Chromium-6Molybdenum–Cobalt-28 Chromium-6~~ **Molybdenum Alloy Forgings for Surgical Implants (UNS R31537, R31538, R31539)¹**

This standard is issued under the fixed designation F799; 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 reappraisal. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reappraisal.

1. Scope*

1.1 This specification covers requirements of ~~cobalt-28chromium-6molybdenum–cobalt-28 chromium-6 molybdenum~~ alloy (UNS R31537, R31538, R31539) high-strength forgings for the manufacture of surgical implants. The properties specified in this document specifically apply to finished or semifinished parts that receive no subsequent thermomechanical processing.

1.2 Wrought material to be used as forging stock in the manufacture of forgings conforming to this specification, typically hot worked and unannealed with a surface finish suitable for forging, shall be fabricated and supplied in accordance with Specification F1537.

1.3 Units—The SI units in this standard are the primary units. The values stated in either primary SI units or secondary inch-pound units are to be regarded separately as standard. The values stated in each system may not be exact equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems may result in non-conformance with the standard.

1.4 *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

~~E8E8/E8M~~ Test Methods for Tension Testing of Metallic Materials—[Metric] E0008_E0008M

E18 Test Methods for Rockwell Hardness of Metallic Materials

E29 Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications

E112 Test Methods for Determining Average Grain Size [10.1520/F0799-19](https://doi.org/10.1520/F0799-19)

~~E165E165/E165M~~ Practice for Liquid Penetrant Testing for General Industry

E930 Test Methods for Estimating the Largest Grain Observed in a Metallographic Section (ALA Grain Size)

F75 Specification for Cobalt-28 Chromium-6 Molybdenum Alloy Castings and Casting Alloy for Surgical Implants (UNS R30075)

F601 Practice for Fluorescent Penetrant Inspection of Metallic Surgical Implants

F981 Practice for Assessment of Compatibility of Biomaterials for Surgical Implants with Respect to Effect of Materials on Muscle and Insertion into Bone

F1537 Specification for Wrought Cobalt-28Chromium-6Molybdenum Alloys for Surgical Implants (UNS R31537, UNS R31538, and UNS R31539)

~~ASTMIEEE/ASTM~~ SI 10 American National Standard for Use of the International System of Units (SI): The Modern Metric System

2.2 ISO Standards:³

~~ISO 68926892-1~~ Metallic Materials—Tensile Testing at Ambient Temperaturematerials – Tensile testing – Part 1: Method of test at room temperature

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.

Current edition approved June 1, 2014 May 15, 2019. Published June 2014 June 2019. Originally approved in 1982. Last previous edition approved in 20062011 as F799 – 06.11. DOI: ~~10.1520/F0799-11~~ 10.1520/F0799-19.

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

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

ISO 9001 Quality Management Systems—Requirements—management systems – Requirements

~~2.3 American Society for Quality Standard.⁴~~

~~ASQ C1 Specification of General Requirements for a Quality Program~~

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *lot, n*—the total number of forgings produced from the same heat of starting material under the same conditions at essentially the same time.

4. Ordering Information

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

- 4.1.1 Quantity, number of pieces
- 4.1.2 ASTM designation, date of issue, and alloy number,
- 4.1.3 Units to be certified (SI or inch-pound),
- 4.1.4 Condition,
- 4.1.5 Mechanical properties,
- 4.1.6 Finish,
- 4.1.7 Applicable dimensions or drawing number,
- 4.1.8 Special tests, if any, and
- 4.1.9 Other requirements.

5. Materials and Manufacture

5.1 Materials for forgings shall be bar, rod, or wire fabricated in accordance with Specification **F1537**.

5.2 The material shall be forged by hammering, pressing, rolling, extruding, or upsetting, and shall be processed, if practical, so as to cause metal flow during the hot-working operation to be in the most favorable direction for resisting stresses encountered in service, as may be indicated to the supplier by the purchaser.

5.3 Forgings shall be free of splits, scale, cracks, flaws, and other imperfections not consistent with good commercial practice (see **Note 1**). Offset or mismatch allowance, dependent upon part size and configuration, shall be within standard forging tolerances.

5.4 Optional ~~identification~~identification marks, including the purchaser’s logo, material designation, heat code number, and impression number, may be placed upon each forging, the method and location of which shall be as specified by the purchaser.

NOTE 1—Compliance ~~to~~with these requirements may be verified by Test Method Practice ~~E165~~E165/E165M or Practice **F601**, or other suitable methods.

6. Chemical Requirements

6.1 The ~~cobalt-28chromium-6molybdenum-cobalt-28 chromium-6 molybdenum~~ cobalt-28 chromium-6 molybdenum alloy forgings shall conform to the chemical requirements prescribed in Table 1 of Specification **F1537**. The supplier shall not ship material that is outside the limits specified in Table 1 of Specification **F1537** for the applicable alloys. Specification **F1537** contains three alloys:

Alloy 1	Low Carbon (UNS R31537)
Alloy 2	High Carbon (UNS R31538)
Alloy 3	Dispersion Strengthened (UNS R31539)

7. Mechanical Requirements

7.1 *Tensile Properties:*

7.1.1 Tensile properties shall be determined in accordance with Test Methods **E8E8/E8M**.

7.1.2 The mechanical properties of test specimens prepared from finished or semifinished parts shall conform to the requirements in **Table 1**.

7.1.3 Tension test specimens shall be produced from finished or ~~semifinished~~semi-finished parts or from material having the same process history as that which exists in the final forging. Tension specimens may have a ground finish on the reduced section and may be taken in a direction parallel to the long axis of the finished or ~~semifinished~~semi-finished part.

7.1.4 A minimum of two tension test specimens shall be tested. Should either of the two specimens not meet the specified requirements, two additional specimens shall be tested and both must pass.

7.1.5 If any fracture takes place outside the middle half of the gauge length or in a punched or scribed gauge mark within the reduced section, the elongation value obtained may not be representative of the material. In acceptance testing, if the elongation so measured meets the minimum requirements specified, no further testing is required, but if the elongation is less than the minimum requirements, discard the test and retest.