AEROSPACE MATERIAL SPECIFICATION

AMS5894™	REV. E
Issued 1993-01 Revised 2022-04 Superseding AMS5894D	

Cobalt Alloys, Bars, Sheet, and Plate
60Co - 28Cr - 4.5W - 1.15C
Solution Heat Treated

RATIONALE

AMS5894E is the result of a Five-Year Review and update of the specification. The revision prohibits unauthorized exceptions (3.4.3, 3.7, 4.4.1, 4.4.2, 5.1.3, 8.4), updates chemistry reporting (3.1.1), updates condition (3.2.1), adds continuous furnace requirements (3.3.1), provides strain rate for tensile testing (3.4.1.1), updates definitions (8.2), and permits prior revisions (8.5).

1. SCOPE

1.1 Form

This specification covers a cobalt alloy in the form of sheet and plate up to 1 inch (25 mm) in nominal thickness or round bars up to 3-1/2 inches (89 mm) in nominal diameter.

1.2 Application

These products have been used typically for parts requiring wear resistance and minimum galling or seizing tendencies at room and elevated temperatures, but usage is not limited to such applications.

2. APPLICABLE DOCUMENTS

The issue of the following documents in effect on the date of the purchase order forms a part of this specification to the extent specified herein. The supplier may work to a subsequent revision of a document unless a specific document issue is specified. When the referenced document has been cancelled and no superseding document has been specified, the last published issue of that document shall apply.

2.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or +1 724-776-4970 (outside USA), www.sae.org.

AMS2261	Tolerances, Nickel, Nickel Alloy, and Cobalt Alloy Bars, Rods, and Wire
AMS2269	Chemical Check Analysis Limits, Nickel, Nickel Alloys, and Cobalt Alloys
AMS2371	Quality Assurance Sampling and Testing, Corrosion and Heat-Resistant Steels and Alloys, Wrought Products and Forging Stock

TO PLACE A DOCUMENT ORDER: **Tel: 877-606-7323 (inside USA and Canada)**
Tel: +1 724-776-4970 (outside USA)
Fax: 724-776-0790
Email: CustomerService@sae.org
SAE WEB ADDRESS: **http://www.sae.org**

For more information on this standard, visit
https://www.sae.org/standards/content/AMS5894E/

AMS2750 Pyrometry

AMS2806 Identification, Bars, Wire, Mechanical Tubing, and Extrusions, Carbon and Alloy Steels and Corrosion and Heat-Resistant Steels and Alloys

AMS2807 Identification, Carbon and Low-Alloy Steels, Corrosion and Heat-Resistant Steels and Alloys, Sheet, Strip, Plate, and Aircraft Tubing

AS4194 Sheet and Strip Surface Finish Nomenclature

AS7766 Terms Used in Aerospace Metals Specifications

2.2 ASTM Publications

Available from ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959, Tel: 610-832-9585, www.astm.org.

ASTM A480/A480M Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip

ASTM E8/E8M Tension Testing of Metallic Materials

ASTM E18 Rockwell Hardness of Metallic Materials

ASTM E354 Chemical Analysis of High-Temperature, Electrical, Magnetic, and Other Similar Iron, Nickel and Cobalt Alloys

3. TECHNICAL REQUIREMENTS

3.1 Composition

Shall conform to the percentages by weight shown in Table 1, determined in accordance with ASTM E354, or by other analytical methods acceptable to purchaser.

Table 1 - Composition

Element	Min	Max
Carbon	0.90	1.40
Manganese	0.5	2.0
Silicon	0.2	2.0
Phosphorus	--	0.04
Sulfur	--	0.03
Chromium	28.00	32.00
Tungsten	3.50	5.50
Nickel	--	3.0
Molybdenum	--	1.50
Iron	--	3.0
Cobalt	remainder	

3.1.1 Producer may test for any element not listed in Table 1 and include this analysis in the report of 4.4. Reporting of any element not listed in the composition table is not a basis for rejection, unless limits of acceptability are specified by the purchaser.

3.1.2 Check Analysis

Composition variations shall meet the applicable requirements of AMS2269.

3.2 Condition

The product shall be supplied in the following condition:

3.2.1 Sheet and Plate

Hot or cold rolled, solution heat treated, and unless solution heat treatment is performed in an atmosphere yielding a bright finish, descaled with a No. 1 finish as described in ASTM A480/A480M and AS4194.

3.2.2 Bar

Solution heat treated with a turned or ground finish.

3.2.2.1 Bars shall not be cut from plate (also see 4.4.2).

3.3 Solution Heat Treatment

The product shall be solution heat treated by heating to 2250 °F ± 25 °F (1232 °C ± 14 °C), holding at heat for a time commensurate with cross-section but not less than 15 minutes, and cooling at a rate equivalent to a still air cool or faster. Pyrometry shall be in accordance with AMS2750.

3.3.1 Continuous Heat Treatment

When continuous heat treating is used process parameters (e.g., furnace temperature set points, heat input, travel rate, etc.) for continuous heat treating lines shall be established by the material producer and validated by testing of product to the requirements of 3.4.

3.4 Properties

The product shall conform to the following requirements:

3.4.1 Tensile Properties

Shall be shown in Table 2; determined in accordance with ASTM E8/E8M. Bars shall be tested in the longitudinal direction. Sheet and plate shall be tested in the transverse direction. Reduction in area is not applicable to plate or sheet under 0.5 inch (12.7 mm) in nominal thickness.

3.4.1.1 Unless otherwise specified, the strain rate shall be set at 0.005 in/in/min (0.005 mm/mm/min) and maintained within a tolerance of ±0.002 in/in/min (0.002 mm/mm/min) through 0.2% offset yield strain. The strain rate after yield may be increased to any value up to 0.5 in/in/min (or 0.5 mm/mm/min) or equivalent crosshead speed as a function of gage length. The requirement for compliance becomes effective for material produced 1 year after the publication date of this document.

Table 2 - Minimum tensile properties

Property	Value
Tensile Strength	130 ksi (896 MPa)
Yield Strength at 0.2% Offset	70 ksi (483 MPa)
Elongation in 4D	5%
Reduction of Area	7%

3.4.2 Hardness

Shall be 33 to 43 HRC, determined in accordance with ASTM E18.

3.4.3 Mechanical property requirements for product outside the size range covered by 1.1 shall be agreed upon between purchaser and producer and reported per 4.4.1.

3.5 Quality

The product, as received by purchaser shall be uniform in quality and condition, sound, and free from foreign materials and from imperfections detrimental to usage of the product.

3.6 Tolerances

Shall conform to all applicable requirements of the following:

3.6.1 Bars

Shall be in accordance with AMS2261.

3.6.2 Sheet and Plate

Not applicable unless separately agreed upon.

3.7 Exceptions

Any exceptions shall be authorized by the purchaser and reported as in 4.4.1.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for Inspection

The producer of the product shall supply all samples for producer's tests and shall be responsible for the performance of all required tests. Purchaser reserves the right to sample and to perform any confirmatory testing deemed necessary to ensure that the product conforms to specified requirements.

4.2 Classification of Tests

All technical requirements are acceptance tests and shall be performed on each heat or lot as applicable.

4.3 Sampling and Testing

Shall be in accordance with AMS2371.

4.4 Reports

The producer of the product shall furnish with each shipment a report showing the producers name and country where the metal was melted (e.g., final melt in the case of metal processed by multiple melting operations), and the results of tests for composition of each heat and for tensile properties and hardness of each lot, and stating that the product conforms to the other technical requirements. This report shall include the purchase order number, heat and lot numbers, AMS5894E, product form, size, and quantity.

4.4.1 When material produced to this specification is beyond the sizes allowed in the scope or tables, or other exceptions are taken to the technical requirements listed in Section 3, the report shall contain a statement "This material is certified as AMS5894E(EXC) because of the following exceptions:" and the specific exceptions shall be listed (also see 5.1.3).

4.4.2 Report the nominal metallurgically worked cross sectional size and the cut size, if different (see 3.2.2.1).

4.5 Resampling and Retesting

Shall be in accordance with AMS2371.

5. PREPARATION FOR DELIVERY

5.1 Identification

Shall be as follows: