



<b>AEROSPACE MATERIAL SPECIFICATION</b>	<b>AMS5759™</b>	<b>REV. M</b>
	Issued 1986-02 Revised 2015-12	
	Superseding AMS5759L	
Cobalt Alloy, Corrosion and Heat-Resistant, Bars, Forging Stock, Forgings, and Rings 52Co – 20Cr – 10Ni – 15W (Similar to UNS R30605)		

### RATIONALE

AMS5759M revises condition (3.3.1.2), Properties (3.5.1.3) and Reports (4.4, 4.4.6, 4.4.7), and is a Five Year Review and update of this specification.

#### 1. SCOPE

##### 1.1 Form

This specification covers a corrosion and heat-resistant cobalt alloy in the form of bars, forgings, flash welded rings, and stock for forging, flash welded rings, or heading.

##### 1.2 Application

These products have been used typically for parts requiring high strength up to 1500 °F (816 °C) and oxidation resistance up to 2000 °F (1093 °C), 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](http://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
- AMS2374 Quality Assurance Sampling and Testing, Corrosion and Heat-Resistant Steel and Alloy Forgings

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AMS2750	Pyrometry
AMS2806	Identification Bars, Wire, Mechanical Tubing, and Extrusions, Carbon and Alloy Steels and Corrosion and Heat-Resistant Steels and Alloys
AMS2808	Identification Forgings
AMS7490	Rings, Flash Welded, Corrosion and Heat-Resistant Austenitic Steels, Austenitic-Type Iron, Nickel, or Cobalt Alloys, or Precipitation-Hardenable Alloys

## 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](http://www.astm.org).

ASTM E8/E8M	Tension Testing of Metallic Materials
ASTM E10	Brinell Hardness of Metallic Materials
ASTM E139	Conducting Creep, Creep-Rupture, and Stress-Rupture Tests 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 by wet chemical methods in accordance with ASTM E354, by spectrochemical methods, or by other analytical methods acceptable to purchaser.

**Table 1 - Composition**

Element	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	remainder	

### 3.1.1 Check Analysis

Composition variations shall meet the applicable requirements of AMS2269.

### 3.2 Melting Practice

Alloy shall be multiple melted using consumable electrode practice in the remelt cycle.

### 3.3 Condition

The product shall be supplied in the following condition:

#### 3.3.1 Bars, Forgings, and Flash Welded Rings

Solution heat treated and descaled.

3.3.1.1 Bars shall be hot finished; round bars shall be ground or turned.

3.3.1.2 Bars shall not be cut from plate (also see 4.4.6).

3.3.1.3 Flash welded rings shall not be supplied unless specified or permitted on purchaser's part drawing. When supplied, rings shall be manufactured in accordance with AMS7490.

#### 3.3.2 Stock for Forging, Flash Welded Rings, or Heading

As ordered by the forging, flash welded ring, or heading manufacturer.

### 3.4 Heat Treatment

Bars, forgings, and flash welded rings shall be solution heat treated by heating to a temperature within the range 2150 to 2250 °F (1177 to 1232 °C), holding at the selected temperature within  $\pm 25$  °F ( $\pm 14$  °C) for a time commensurate with section thickness, and cooling at a rate equivalent to an air cool or faster. Pyrometry shall be in accordance with AMS2750.

### 3.5 Properties

The product shall conform to the following requirements:

#### 3.5.1 Bars, Forgings, and Flash Welded Rings

##### 3.5.1.1 Tensile Properties

Shall be shown in Table 2, determined in accordance with ASTM E8/E8M.

**Table 2 - Minimum tensile properties**

Property	Value
Tensile Strength	125 ksi (862 MPa)
Yield Strength at 0.2% Offset	45.0 ksi (310 MPa)
Elongation in 4D	30%

### 3.5.1.2 Hardness

Shall be as follows, determined in accordance with ASTM E10. Product shall not be rejected on the basis of hardness if the tensile properties of 3.5.1.1 are acceptable, determined on specimens taken from the same sample as that with nonconforming hardness or from another sample with similar nonconforming hardness.

#### 3.5.1.2.1 Bars

Not higher than 277 HB, or equivalent (see 8.2), taken approximately midway between surface and center.

#### 3.5.1.2.2 Forgings

Not higher than 248 HB, or equivalent (see 8.2).

#### 3.5.1.2.3 Flash Welded Rings

Not higher than 302 HB, or equivalent (see 8.2).

### 3.5.1.3 Stress-Rupture Properties at 1,500 °F (816 °C)

Product 0.1875 inch (4.76 mm) and greater in thickness or least distance between parallel sides shall be tested as follows: A tensile specimen, maintained at 1500 °F  $\pm$  3 °F (816 °C  $\pm$  2 °C) while a load sufficient to produce an initial axial stress of 24.0 ksi (165 MPa) or higher is applied continuously, shall not rupture in less than 24 hours. The test shall be continued to rupture without change of load. Elongation after rupture, measured at room temperature, shall be not less than 10% in 4D. Tests shall be conducted in accordance with ASTM E139.

3.5.1.3.1 The test of 3.5.1.3 may be conducted using incremental loading. In such case, the load required to produce an initial axial stress of 24.0 ksi (165 MPa) or higher shall be used to rupture or for 24 hours, whichever occurs first. After the 24 hours and at intervals of 8 hours minimum, thereafter, the stress shall be increased in increments of 5.0 ksi (34.5 MPa). Time to rupture and elongation requirements shall be as specified in 3.5.1.3.

### 3.5.2 Stock for Forging, Flash Welded Rings, and Heading

As agreed upon by purchaser and producer.

## 3.6 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.

3.6.1 Grain flow of die forgings, except in areas which contain flash-line end grain, shall follow the general contour of the forgings showing no evidence of reentrant grain flow.

## 3.7 Tolerances

Bars shall conform to all applicable requirements of AMS2261.

## 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

### 4.2.1 Acceptance Tests

The following requirements are acceptance tests and shall be performed on each heat or lot as applicable:

4.2.1.1 Composition (3.1) of each heat.

4.2.1.2 Tensile properties (3.5.1.1) and hardness (3.5.1.2) of each lot of bars, forgings, and flash welded rings.

4.2.1.3 Tolerances (3.7) of bars.

### 4.2.2 Periodic Tests

The following requirements are periodic tests and shall be performed at a frequency selected by the producer unless frequency of testing is specified by purchaser:

4.2.2.1 Stress-rupture properties (3.5.1.3) of bars, forgings, and flash welded rings.

4.2.2.2 Ability of stock for forging, flash welded rings, and heading (3.5.2) to develop required properties.

4.2.2.3 Grain flow of die forgings (3.6.1).

## 4.3 Sampling and Testing

Shall be as follows:

4.3.1 Bars, Flash Welded Rings, and Stock for Forging, Flash Welded Rings, or Heading

In accordance with AMS2371.

4.3.2 Forgings

In accordance with AMS2374.

## 4.4 Reports

The producer of the product shall furnish with each shipment a report showing the producer's name and country where the metal was melted (e.g., final melt in the case of metal processed by multiple melting operations) and the following results of tests and relevant information:

4.4.1 For each heat

Composition.

4.4.2 For each lot of bars, forgings, and flash welded rings.

Tensile Properties

Hardness.

4.4.3 A statement that the product conforms to the other technical requirements.

4.4.4 Purchase order number

Heat and lot numbers

AMS5759M

Product form

Size

Quantity.