AEROSPACE MATERIAL SPECIFICATION

AMS5747™	REV. E

Issued 1977-07
Revised 2018-06
Reaffirmed 2022-11

Superseding AMS5747D

Nickel Alloy, Corrosion- and Heat-Resistant, Bars, Forgings, and Rings
72Ni - 15.5Cr - 0.95Cb(Nb) - 2.5Ti - 0.70Al - 7.0Fe
1800 °F (982 °C) Solution Heat Treated, Precipitation Hardenable
(Composition similar to UNS N07750)

RATIONALE

AMS5747E revises title, condition (3.2.1.2), properties (3.4), reports (4.4), and identification (5.2.1.1), adds exceptions (3.7), and is a Five-Year Review and update of this specification.

AMS5747E has been reaffirmed to comply with the SAE Five-Year Review policy.

1. SCOPE

1.1 Form

This specification covers a corrosion and heat-resistant nickel alloy in the form of bars, forgings, and flash welded rings up to 4.00 inches, including (101.6 mm, including) in nominal diameter or least distance between parallel sides, and stock of any size for forging or flash welded rings (see 8.5).

1.2 Application

These products have been used typically for parts requiring high strength in the range 800 °F to 1100 °F (427 °C to 593 °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), or 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/AMS5747E/

AMS2374 Quality Assurance Sampling and Testing, Corrosion and Heat-Resistant Steel and Alloy Forgings

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

ARP1917 Clarification of 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, or www.astm.org.

ASTM E8/E8M Tension Testing of Metallic Materials

ASTM E10 Brinell Hardness of Metallic Materials

ASTM E140 Hardness Conversion Tables for Metals Relationship Among Brinell Hardness, Vickers Hardness, Rockwell Hardness, Superficial Hardness, Knoop Hardness, Scleroscope Hardness, and Leeb Hardness

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	--	0.08
Manganese	--	1.00
Silicon	--	0.50
Phosphorus (3.1.1)	--	0.015
Sulfur	--	0.010
Chromium	14.00	17.00
Nickel	70.00	--
Columbium (Niobium)	0.70	1.20
Titanium	2.25	2.75
Aluminum	0.40	1.00
Iron	5.00	9.00
Cobalt (3.1.1)	--	1.00
Copper	--	0.50

3.1.1 Determination not required for routine acceptance.

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 Bars

Hot finished, solution heat treated, and descaled.

3.2.1.1 Round bars shall be ground or turned except that bars under 0.50 inch (12.7 mm) in nominal diameter shall be cold drawn when so ordered.

3.2.1.2 Bars shall not be cut from plate (also see 4.4.1).

3.2.2 Forgings and Flash Welded Rings

Solution heat treated.

3.2.2.1 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.

3.2.3 Stock for Forging or Flash Welded Rings

As ordered by the forging or flash welded ring manufacturer.

3.3 Heat Treatment

Bars, forgings, and flash welded rings shall be solution treated by heating to 1800 °F ± 25 °F (982 °C ± 14 °C), holding at heat for a time commensurate with cross-sectional thickness, and cooling at a rate equivalent to an air cool or faster.

3.4 Properties

The product shall conform to the following requirements:

3.4.1 Bars, Forgings, and Flash Welded Rings

3.4.1.1 As Solution Heat Treated

3.4.1.1.1 Hardness

Shall be not higher than 321 HB, or equivalent (see 8.2), determined in accordance with ASTM E10.

3.4.1.2 After Precipitation Heat Treatment

The product shall have the following properties after being precipitation heat treated by heating to 1350 °F ± 15 °F (732 °C ± 8 °C), holding at heat for 8 hours ± 0.5 hour, cooling at a rate of 100 °F ± 15 °F (56 °C ± 8 °C) per hour to 1150 °F ± 15 °F (621 °C ± 8 °C), holding at 1150 °F ± 15 °F (621 °C ± 8 °C) for 8 hours ± 1 hour, and cooling in air. Instead of the 100 °F (56 °C) per hour cooling rate to 1150 °F ± 15 °F (621 °C ± 8 °C), the product may be furnace cooled at any rate provided the time at 1150 °F ± 15 °F (621 °C ± 8 °C) is adjusted to give a total precipitation heat treatment time of 18 hours.

3.4.1.2.1 Tensile Properties

Shall be as shown in Table 2 for product up to 4.00 inches (101.6 mm) in nominal diameter or least distance between parallel sides, determined in accordance with ASTM E8/E8M; properties apply to specimens taken with the axis approximately parallel to the grain flow and to specimens taken in the radial direction and in the tangential direction at the rim of disc forgings.

Table 2

Table 2A - Minimum tensile properties, inch/pound units

Nominal Diameter or Least Distance Between Parallel Sides Inches	Tensile Strength ksi	Yield Strength at 0.2% Offset ksi	Elongation in 4D %	Reduction of Area %
Up to 2.50, excl	170.0	115.0	18	18
2.50 to 4.00, excl	170.0	115.0	15	15

Table 2B - Minimum tensile properties, SI units

Nominal Diameter or Least Distance Between Parallel Sides Millimeters	Tensile Strength MPa	Yield Strength at 0.2% Offset MPa	Elongation in 4D %	Reduction of Area %
Up to 63.5, excl	1172	793	18	18
63.5 to 101.6, excl	1172	793	15	15

3.4.1.2.2 Mechanical property requirements for product outside of the range covered by 1.1 shall be agreed upon between producer and purchaser.

3.4.1.2.3 Hardness

Shall be 302 to 388 HB, or equivalent (see 8.2), determined in accordance with ASTM E10.

3.4.2 Forging Stock

When a sample of stock is forged to a test coupon and heat treated as in 3.3 and 3.4.1.2, specimens taken from the heat treated coupon shall conform to the requirements of 3.4.1.2.1 and 3.4.1.2.2. If specimens taken from the stock after heat treatment as in 3.3 and 3.4.1.2 conform to the requirements of 3.4.1.2.1 and 3.4.1.2.2, the tests shall be accepted as equivalent to tests of a forged coupon.

3.4.3 Stock for Flash Welded Rings

Specimens taken from the stock after heat treatment as in 3.3 and 3.4.1.2 shall conform to the requirements of 3.4.1.2.1 and 3.4.1.2.2.

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.

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

3.6 Tolerances

Bars shall conform to all applicable requirements of AMS2261.

3.7 Exceptions

Any exceptions shall be authorized by purchaser and reported as in 4.4.2.

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 (see 3.1.1).

4.2.1.2 Hardness (3.4.1.1.1) of each lot of bars, forgings, and flash welded rings as solution heat treated.

4.2.1.3 Tensile properties (3.4.1.2.1) and hardness (3.4.1.2.2) of each lot of bars, forgings, and flash welded rings after precipitation heat treatment.

4.2.1.4 Tolerances (3.6) of bars and forging stock.

4.2.2 Periodic Tests

Forging stock (3.4.2) and of stock for flash welded rings (3.4.3) to demonstrate ability to develop required properties and grain flow of die forgings (3.5.1) are periodic tests and shall be performed at a frequency selected by the producer unless frequency of testing is specified by purchaser.

4.3 Sampling and Testing

Shall be as follows:

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

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 results of tests for composition (see 3.1.1) of each heat, hardness as solution heat treated of each lot, tensile properties and hardness after precipitation heat treatment 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, AMS5747E, size, and quantity. If forgings are supplied, the size and melt source of stock used to make the forgings shall also be included.

4.4.1 If the ship size/shape is cut from a larger cross section, report the nominal metallurgically worked size (also see 3.2.1.2).

4.4.2 When material produced to this specification is beyond the sizes allowed in the scope or tables, or other exceptions authorized by purchaser (see 3.7) are taken to the technical requirements listed in Section 3 (see 5.2.4), the report shall contain a statement “This material is certified as AMS5747E(EXC) because of the following exceptions.” and the specific exceptions shall be listed.