



AEROSPACE MATERIAL SPECIFICATION

AMS5660™**REV. M**Issued 1959-06
Revised 2020-06

Superseding AMS5660L

Nickel-Iron Alloy, Corrosion and Heat-Resistant, Bars and Forgings
12.5Cr - 42.5Ni - 6.0Mo - 2.7Ti - 0.015B - 34Fe
Consumable Electrode Remelted or Vacuum Induction Melted
Solution, Stabilization, and Precipitation Heat Treated
(Composition similar to UNS N09901)

RATIONALE

AMS5660M prohibits unauthorized exceptions (3.8), revises reports (4.4) and identification (5.2.1.1), and results from a Five-Year Review and update of this specification.

1. SCOPE

1.1 Form

This specification covers a corrosion and heat-resistant nickel-iron alloy in the form of bars and forgings 5 inches (127 mm) and under, and forging stock of any size (see 8.6).

1.2 Application

These products have been used typically for parts, such as turbine rotors, shafts, and blades, requiring high strength up to 1400 °F (760 °C) and oxidation resistance up to 1600 °F (871 °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.

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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For more information on this standard, visit
<https://www.sae.org/standards/content/AMS5660M>

Documents

Document Sharing Hub

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
ARP1313	Determination of Trace Elements in High Temperature 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, 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 E140	Hardness Conversion Tables for Metals Relationship Among Brinell Hardness, Vickers Hardness, Rockwell Hardness, Superficial Hardness, Knoop Hardness, Scleroscope Hardness, and Leeb Hardness
ASTM E292	Conducting Time-for-Rupture Notch Tension Tests of 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, by the methods of ARP1313 for lead, bismuth, and selenium, or by other analytical methods acceptable to purchaser.

Table 1 - Composition

Element	Min	Max
Carbon	--	0.10
Manganese	--	1.00
Silicon	--	0.60
Phosphorus	--	0.030
Sulfur	--	0.030
Chromium	11.00	14.00
Nickel	40.00	45.00
Molybdenum	5.00	7.00
Titanium	2.35	3.10
Boron	0.010	0.020
Cobalt	--	1.00
Aluminum	--	0.35
Copper	--	0.50
Lead	--	0.0005 (5 ppm)
Bismuth	--	0.00003 (0.3 ppm)
Selenium	--	0.0003 (3 ppm)
Iron	remainder	

3.1.1 Check Analysis

Composition variations shall meet the applicable requirements of AMS2269; no variation over maximum is permitted for lead, bismuth, and selenium.

3.2 Melting Practice

Alloy shall be multiple melted using consumable electrode practice in the remelt cycle or shall be induction melted under vacuum. If consumable electrode remelting is not performed in vacuum, electrodes which have been produced by vacuum induction melting shall be used for remelting.

3.3 Condition

The product shall be supplied in the following condition:

3.3.1 Bars

Hot finished and solution, stabilization, and precipitation heat treated. Rounds shall be ground or turned.

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

3.3.2 Forgings

Solution, stabilization, and precipitation heat treated.

3.3.3 Forging Stock

As ordered by the forging manufacturer.

3.4 Heat Treatment

Bars and forgings shall be solution, stabilization, and precipitation heat treated as follows; pyrometry shall be in accordance with AMS2750.

3.4.1 Solution Heat Treatment

Heat to a temperature within the range 1975 to 2025 °F (1079 to 1107 °C), hold at the selected temperature within ± 25 °F (± 14 °C) for 2 hours ± 0.25 hour, and cool at a rate equivalent to an air cool or faster.

3.4.2 Stabilization Heat Treatment

Heat to a temperature within the range 1425 to 1475 °F (774 to 802 °C), hold at the selected temperature within ± 15 °F (± 8 °C) for 2 to 4 hours, and cool at a rate equivalent to an air cool or faster.

3.4.3 Precipitation Heat Treatment

Heat to a temperature within the range 1325 to 1375 °F (718 to 746 °C), hold at the selected temperature within ± 15 °F (± 8 °C) for 24 hours ± 1 hour, and cool at any convenient rate.

3.5 Properties

Product 5.0 inches (127 mm) and under in nominal diameter or least distance between parallel sides shall conform to the following requirements: