



# AEROSPACE MATERIAL

Society of Automotive Engineers, Inc.  
400 COMMONWEALTH DRIVE, WARRENDALE, PA. 15096

## SPECIFICATION

**AMS 5666B**

Superseding AMS 5666A

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UNS N06625

ALLOY BARS, FORGINGS, AND RINGS, CORROSION AND HEAT RESISTANT  
62Ni - 21.5Cr - 9.0Mo - 3.65 (Cb+Ta)

### 1. SCOPE:

- 1.1 Form: This specification covers a corrosion and heat resistant nickel alloy in the form of bars, forgings, flash welded rings, extrusions, and stock for forging or flash welded rings.
- 1.2 Application: Primarily for parts and assemblies requiring both corrosion and oxidation resistance up to 2000°F (1095°C) and where such parts may require welding during fabrication.

2. APPLICABLE DOCUMENTS: The following publications form a part of this specification to the extent specified herein. The latest issue of Aerospace Material Specifications (AMS) shall apply. The applicable issue of other documents shall be as specified in AMS 2350.

- 2.1 SAE Publications: Available from Society of Automotive Engineers, Inc., 400 Commonwealth Drive, Warrendale, PA 15096.

#### 2.1.1 Aerospace Material Specifications:

- AMS 2261 - Tolerances, Nickel, Nickel Base, and Cobalt Base Alloy Bars and Forging Stock
- AMS 2269 - Chemical Check Analysis Limits, Wrought Nickel Alloys and Cobalt Alloys
- AMS 2350 - Standards and Test Methods
- AMS 2371 - Quality Assurance Sampling of Corrosion and Heat Resistant Steels and Alloys, Wrought Products Except Forgings and Forging Stock
- AMS 2374 - Quality Assurance Sampling of Corrosion and Heat Resistant Steels and Alloys, Forgings and Forging Stock
- AMS 2375 - Control of Forgings Requiring First Article Approval
- AMS 2806 - Identification, Bars, Wire, Mechanical Tubing, and Extrusions, Carbon and Alloy Steels and Heat and Corrosion Resistant Steels and Alloys
- AMS 2808 - Identification, Forgings
- AMS 7490 - Rings, Flash Welded, Corrosion and Heat Resistant Austenitic Steels and Austenitic-Type Alloys

- 2.2 ASTM Publications: Available from American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.

- ASTM E8 - Tension Testing of Metallic Materials
- ASTM E18 - Rockwell Hardness and Rockwell Superficial Hardness of Metallic Materials
- ASTM E112 - Estimating the Average Grain Size of Metals
- ASTM E354 - Chemical Analysis of High-Temperature, Electrical, Magnetic, and Other Similar Iron, Nickel, and Cobalt Alloys

- 2.3 U.S. Government Publications: Available from Commanding Officer, Naval Publications and Forms Center, 5801 Tabor Avenue, Philadelphia, PA 19120.

#### 2.3.1 Federal Standards:

Federal Test Method Standard No. 151 - Metals; Test Methods

SAE Technical Board rules provide that: "All technical reports, including standards approved and practices recommended, are advisory only. Their use by anyone engaged in industry or trade or their use by governmental agencies is entirely voluntary. There is no agreement to adhere to any SAE standard or recommended practice, and no commitment to conform to or be guided by any technical report. In formulating and approving technical reports, the Board and its Committees will not investigate or consider patents which may apply to the subject matter. Prospective users of the report are responsible for protecting themselves against liability for infringement of patents."

2.3.2 Military Standards:

MIL-STD-163 - Steel Mill Products, Preparation for Shipment and Storage

3. TECHNICAL REQUIREMENTS:

- 3.1 Composition: Shall conform to the following percentages by weight, determined by wet chemical methods in accordance with ASTM E354, by spectrographic methods in accordance with Federal Test Method Standard No. 151, Method 112, or by other analytical methods approved by purchaser:

|                      | min                       | max   |
|----------------------|---------------------------|-------|
| Carbon               | --                        | 0.10  |
| Manganese            | --                        | 0.50  |
| Silicon              | --                        | 0.50  |
| Phosphorous          | --                        | 0.015 |
| Sulfur               | --                        | 0.015 |
| Chromium             | 20.00 -                   | 23.00 |
| Molybdenum           | 8.00 -                    | 10.00 |
| Columbium + Tantalum | 3.15 -                    | 4.15  |
| Cobalt (3.1.1)       | --                        | 1.00  |
| Titanium             | Present but not exceeding | 0.40  |
| Aluminum             | Present but not exceeding | 0.40  |
| Iron                 | --                        | 5.00  |
| Nickel               | remainder                 |       |

- 3.1.1 Determination not required for routine acceptance.

- 3.1.2 Check Analysis: Composition variations shall meet the requirements of AMS 2269.

- 3.2 Condition: The product shall be supplied in the following condition:

- 3.2.1 Bars: Hot finished and annealed; round bars shall be ground or turned.

- 3.2.2 Forgings, Extrusions, and Flash Welded Rings: Annealed.

- 3.2.2.1 Flash welded rings shall not be supplied unless specified or permitted on purchaser's part drawing. When supplied, they shall be manufactured in accordance with AMS 7490.

- 3.2.3 Stock for Forging or Flash Welded Rings: As ordered by the forging or flash welded ring manufacturer.

- 3.3 Properties: The product shall conform to the following requirements:

- 3.3.1 Bars, Forgings, and Flash Welded Rings:

- 3.3.1.1 Tensile Properties: Shall be as follows, determined in accordance with ASTM E8 on specimens taken from product under 4 in. (100 mm) in least cross-sectional dimension:

|                                    |                       |
|------------------------------------|-----------------------|
| Tensile Strength, min              | 120,000 psi (827 MPa) |
| Yield Strength at 0.2% Offset, min | 60,000 psi (418 MPa)  |
| Elongation in 4D, min              | 30%                   |

- 3.3.1.1.1 Tensile property requirements for product 4 in. (100 mm) and over in least cross-sectional dimension shall be as agreed upon by purchaser and vendor.

- 3.3.1.2 Hardness: Should be not higher than 287 HB or equivalent but the product shall not be rejected on the basis of hardness if the tensile property requirements are met.
- 3.3.1.3 Grain Size: Predominantly 5 or finer, determined in accordance with ASTM E112, for product with a least cross-section dimension under 2-1/2 in. (63.5 mm). For product with a least cross-section dimension 2-1/2 in. (63.5 mm) and over, grain size shall be as agreed upon by purchaser and vendor.
- 3.3.2 Extrusions and Stock for Forging and Flash Welded Rings: Shall be as agreed upon by purchaser and vendor.
- 3.4 Quality: The product, as received by purchaser, shall be uniform in quality and condition, sound, and free from foreign materials and from internal and external imperfections detrimental to usage of the product,
- 3.4.1 Forgings shall have substantially uniform macrostructure and grain flow. Standards for acceptance shall be as agreed upon by purchaser and vendor.
- 3.5 Sizes: Except when exact lengths or multiples of exact lengths are ordered, straight bars will be acceptable in mill lengths of 6 - 24 ft (1.8 - 7.3 m) but not more than 25% of any shipment shall be supplied in lengths of 6 - 9 ft (1.8 - 2.7 m) except that for bars weighing over 25 lb per ft (37 kg/m), short lengths down to 2 ft (600 mm) may be supplied.
- 3.6 Tolerances: Unless otherwise specified, tolerances for bars and forging stock shall conform to all applicable requirements of AMS 2261.

#### 4. QUALITY ASSURANCE PROVISIONS:

- 4.1 Responsibility for Inspection: The vendor of the product shall supply all samples for vendor's tests and shall be responsible for performing all required tests. Results of such tests shall be reported to the purchaser as required by 4.5. Purchaser reserves the right to sample and to perform such confirmatory testing as he deems necessary to ensure that the product conforms to the requirements of this specification.
- 4.2 Classification of Tests:
- 4.2.1 Acceptance Tests: Tests to determine conformance to the following requirements are classified as 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 (3.3.1.1), hardness (3.3.1.2), and grain size (3.3.1.3) of bars, forgings, and flash welded rings of each lot.
- 4.2.1.3 Tolerances (3.6) of bars and forging stock.
- 4.2.2 Preproduction Tests: Tests of forgings to determine conformance to all applicable technical requirements of this specification when AMS 2375 is specified are classified as preproduction tests and shall be performed on the first-article shipment of a forging to a purchaser, when a change in material or processing requires reapproval as in 4.4, and when purchaser deems confirmatory testing to be required.
- 4.2.2.1 For direct U.S. Military procurement of forgings, substantiating test data and, when requested, preproduction forgings shall be submitted to the cognizant agency as directed by the procuring activity, the contracting officer, or the request for procurement.

4.3 Sampling: Shall be in accordance with the following:

4.3.1 Bars, Flash Welded Rings, Extrusions, and Stock for Flash Welded Rings. AMS 2371.

0 4.3.2 Forgings and Forging Stock: AMS 2374.

4.4 Approval: When specified, approval and control of forgings shall be in accordance with AMS 2375.

4.5 Reports:

4.5.1 The vendor of the product shall furnish with each shipment three copies of a report showing the results of tests for chemical composition of each heat and the results of tests on each lot to determine conformance to the other acceptance test requirements of this specification. This report shall include the purchase order number, heat number, AMS 5666B, size, and quantity from each heat. If forgings are supplied, the part number and the size and melt source of stock used to make the forgings shall also be included.

4.5.2 The vendor of finished or semi-finished parts shall furnish with each shipment three copies of a report showing the purchase order number, AMS 5666B, contractor or other direct supplier of material, part number, and quantity. When material for making parts is produced or purchased by the parts vendor, that vendor shall inspect each lot of material to determine conformance to the requirements of this specification, and shall include in the report a statement that the material conforms, or shall include copies of laboratory reports showing the results of tests to determine conformance.

4.6 Resampling and Retesting: Shall be in accordance with the following:

0 4.6.1 Bars, Flash Welded Rings, Extrusions, and Stock for Flash Welded Rings: AMS 2371.

0 4.6.2 Forgings and Forging Stock: AMS 2374.

## 5. PREPARATION FOR DELIVERY:

5.1 Identification: The product shall be identified as follows:

0 5.1.1 Bars and Extrusions: In accordance with AMS 2806.

5.1.2 Forgings: In accordance with AMS 2808.

5.1.3 Flash Welded Rings and Stock for Forging or Flash Welded Rings: As agreed upon by purchaser and vendor.

5.2 Packaging:

5.2.1 The product shall be prepared for shipment in accordance with commercial practice and in compliance with applicable rules and regulations pertaining to the handling, packaging, and transportation of the product to ensure carrier acceptance and safe delivery. Packaging shall conform to carrier rules and regulations applicable to the mode of transportation.

0 5.2.2 For direct U.S. Military procurement, packaging shall be in accordance with MIL-STD-163, Level A or Level C, as specified in the request for procurement. Commercial packaging as in 5.2.1 will be acceptable if it meets the requirements of Level C.