



AEROSPACE MATERIAL

Society of Automotive Engineers, Inc.

400 COMMONWEALTH DRIVE, WARRENDALE, PA. 15096

SPECIFICATION

AMS 5603B

Superseding AMS 5603A

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UNS S14800

STEEL SHEET AND STRIP, CORROSION AND MODERATE HEAT RESISTANT

15Cr - 8.4Ni - 2.2Mo - 1.1Al

Vacuum Induction Melted, Solution Heat Treated

1. SCOPE:

1.1 Form: This specification covers a corrosion-resistant, precipitation-hardenable steel in the form of sheet and strip.

1.2 Application: Primarily for parts requiring corrosion resistance, high strength, high fracture toughness, and oxidation resistance up to 800°F (425°C). Such parts may require welding or brazing during fabrication. Certain processing procedures and service conditions may cause this material to be subject to stress-corrosion cracking; ARP 1110 recommends practices to minimize such conditions.

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) and Aerospace Recommended Practices (ARP) 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 2242 - Tolerances, Corrosion and Heat Resistant Steel and Iron-Base Alloy Sheet, Strip and Plate and Titanium and Titanium Alloy Sheet, Strip, and Plate

AMS 2248 - Chemical Check Analysis Limits, Wrought Heat and Corrosion Resistant Steels and Alloys

AMS 2350 - Standards and Test Methods

AMS 2371 - Quality Assurance Sampling of Corrosion and Heat Resistant Alloys, Wrought Products Except Forgings

2.1.2 Aerospace Recommended Practices:

ARP 1110 - Minimizing Stress Corrosion Cracking in Heat Treatable Wrought Low Alloy and Martensitic Corrosion Resistant Steels

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

ASTM A370 - Mechanical Testing of Steel Products

ASTM E338 - Sharp-Notch Tension Testing of High-Strength Sheet Materials

ASTM E353 - Chemical Analysis of Stainless, Heat-Resisting, Maraging, and Other Similar Chromium-Nickel-Iron Alloys

2.3 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 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 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 E353, by spectrographic methods in accordance with Federal Test Method Standard No. 151, Method 112, or by other approved analytical methods:

| | min | max |
|------------|---------|----------------|
| Carbon | -- | 0.05 |
| Manganese | -- | 0.10 |
| Silicon | -- | 0.10 |
| Phosphorus | -- | 0.010 |
| Sulfur | -- | 0.008 |
| Chromium | 14.75 - | 15.50 |
| Nickel | 8.00 - | 8.75 |
| Molybdenum | 2.00 - | 2.50 |
| Aluminum | 0.90 - | 1.35 |
| Nitrogen | -- | 0.01 (100 ppm) |

3.1.1 Check Analysis: Composition variations shall meet the requirements of AMS 2248.

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

3.2.1 Sheet: Cold rolled, solution heat treated, and descaled (No. 2D Finish).

3.2.2 Strip: Cold rolled, solution heat treated, and descaled (No. 1 Strip Finish).

3.3 Solution Heat Treatment: The product shall be solution heat treated by heating to 1825°F ± 25 (995°C ± 15, holding at heat for not less than 3 min. per 0.10 in. (2.5 mm) of nominal thickness, and cooling in air.

3.4 Properties: The product shall conform to the following requirements; tensile, hardness, and bend testing shall be performed in accordance with ASTM A370:

3.4.1 As Solution Heat Treated:

3.4.1.1 Tensile Properties:

3.4.1.1.1 Product 0.005 In. (0.13 mm) and Over in Thickness:

| | |
|------------------------------------|------------------------|
| Tensile Strength | 150,000 psi (1034 MPa) |
| Yield Strength at 0.2% Offset, max | 65,000 psi (448 MPa) |
| Elongation in 2 in. (50 mm) min | 20% |

3.4.1.1.2 Product Under 0.005 In. (0.13 mm) in Thickness: As agreed upon by purchaser and vendor.

3.4.1.2 Hardness:

3.4.1.2.1 Product Over 0.010 In. (0.25 mm) in Thickness: Not higher than 100 HRB or equivalent.

3.4.1.2.2 Product 0.010 In. (0.25 mm) and Under in Thickness: As agreed upon by purchaser and vendor.

3.4.1.3 Bending: Product shall withstand, without cracking, bending through the angle indicated below around a diameter equal to the nominal thickness of the product with axis of bend parallel to the direction of rolling. Only one type of test will be required in routine inspection; in case of dispute, results of tests using the V-block procedure shall govern.

| Type of Bend | Angle Deg, min |
|--------------|-------------------|
| Free Bend | 180 |
| V-Block | 135 |

3.4.2 After Austenite Conditioning, Subzero Transformation, and Precipitation Hardening: Product shall conform to the following requirements after being heated to 1700°F ± 15 (925°C ± 8) held at heat for not less than 1 hr, rapidly cooled to 75°F (25°C) or lower, cooled to -100°F + 10 (75°C ± 5) within 1 hr, held at this temperature for not less than 8 hr, warmed in air to room temperature, heated to 950°F ± 10 (510°C ± 5), held at heat for not less than 1 hr, and cooled in air.

3.4.2.1 Tensile Properties: Shall be as specified in Table I and 3.4.2.1.1.

TABLE I

| Nominal Thickness Inch | Tensile Strength psi, min | Yield Strength at 0.2% Offset psi, min | Elongation in 2 in. %, min |
|---------------------------|---------------------------------|--|-------------------------------|
| 0.005 to 0.010, excl | 220,000 | 190,000 | 2 |
| 0.010 to 0.020, excl | 220,000 | 190,000 | 3 |
| 0.020 to 0.1875, excl | 220,000 | 190,000 | 4 |

TABLE I (SI)

| Nominal Thickness Millimetres | Tensile Strength MPa, min | Yield Strength at 0.2% Offset MPa, min | Elongation in 50 mm %, min |
|----------------------------------|---------------------------------|--|-------------------------------|
| 0.13 to 0.25, excl | 1517 | 1310 | 2 |
| 0.25 to 0.51, excl | 1517 | 1310 | 3 |
| 0.51 to 4.762, excl | 1517 | 1310 | 4 |

3.4.2.1.1 Tensile property requirements for product under 0.005 in. (0.13 mm) in nominal thickness shall be as agreed upon by purchaser and vendor.

3.4.2.2 Hardness:

3.4.2.2.1 Product Over 0.010 In. (0.25 mm) in Nominal Thickness: Should be not lower than 45 HRC or equivalent but the product shall not be rejected on the basis of hardness if the tensile property requirements are met.

3.4.2.2.2 Product 0.010 In. (0.25 mm) and Under in Nominal Thickness: As agreed upon by purchaser and vendor.

3.4.2.3 Fracture Toughness: When specified, shall be determined by a suitable method. The method of testing and standards for acceptance shall be as agreed upon by purchaser and vendor. ASTM E338 is a suggested method of test.

3.5 Quality:

3.5.1 Steel shall be vacuum induction melted.

3.5.2 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.

3.6 Tolerances: Unless otherwise specified, tolerances shall conform to all applicable requirements of AMS 2242.

4. QUALITY ASSURANCE PROVISIONS:

- 4.1 Responsibility for Inspection: The vendor of the product shall supply all samples and shall be responsible for performing all required tests. Results of such tests shall be reported to the purchaser as required by 4.4. Purchaser reserves the right 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: Tests to determine conformance to all technical requirements of this specification are classified as acceptance tests.
- 4.3 Sampling: Shall be in accordance with AMS 2371 and the following:
- 4.3.1 Specimens for tensile tests of widths 9 in. (229 mm) and over shall be taken with the axis of the specimen perpendicular to the direction of rolling; for widths less than 9 in. (229 mm), specimens shall be taken with the axis parallel to the direction of rolling.
- 4.4 Reports:
- 4.4.1 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 thickness from each heat to determine conformance to the other technical requirements of this specification. This report shall include the purchase order number, heat number, material specification number and its revision letter, size, and quantity from each heat.
- 4.4.2 The vendor of finished or semi-finished parts shall furnish with each shipment three copies of a report showing the purchase order number, material specification number and its revision letter, 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.
- 4.5 Resampling and Retesting: Shall be in accordance with AMS 2371.

5. PREPARATION FOR DELIVERY:

- 5.1 Identification: Each sheet and strip shall be marked on one face, in the respective location indicated below, with AMS 5603B, heat number, manufacturer's identification, and nominal thickness. The characters shall be of such size as to be clearly legible, shall be applied using a suitable marking fluid, and shall be removable in hot alkaline cleaning solution without rubbing. The markings shall have no deleterious effect on the product or its performance and shall be sufficiently stable to withstand normal handling.
- 5.1.1 Flat Strip 6 In. (152 mm) and Under in Width: Shall be marked in one or more lengthwise rows of characters recurring at intervals not greater than 3 ft (914 mm).
- 5.1.2 Flat Sheet Flat Strip Over 6 In. (152 mm) in Width: Shall be marked in lengthwise rows of characters recurring at intervals not greater than 3 ft (914 mm), the rows being spaced not more than 6 in. (152 mm) apart and alternately staggered.
- 5.1.3 Coiled Sheet and Strip: Shall be marked near both the outside and inside ends of the coil; the markings shall be applied as in 5.1 or shall appear on a durable tag or label attached to the coil and marked with the information of 5.1. When the inside end of the coil is inaccessible, as when the product is wound on cores, the tag or label may be attached to the core.