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400 COMMONWEALTH DRIVE, WARRENDALE, PA 15096

# AEROSPACE MATERIAL SPECIFICATION

Submitted for recognition as an American National Standard

AMS 5520C

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Superseding AMS 5520B

## STEEL SHEET, STRIP, AND PLATE, CORROSION AND MODERATE HEAT RESISTANT 15Cr - 7.1Ni - 2.5Mo - 1.1Al Solution Heat Treated, Precipitation Hardenable

UNS S15700



1. SCOPE:

1.1 Form: This specification covers a corrosion and moderate heat resistant steel in the form of sheet, strip, and plate.

1.2 Application: Primarily for parts requiring corrosion resistance and high strength up to 600°F (315°C) and where such parts may require welding during fabrication. Certain design and processing procedures may cause these products to become susceptible 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 and Aerospace Recommended Practices shall apply. The applicable issue of other documents shall be as specified in AMS 2350.

2.1 SAE Publications: Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096.

2.1.1 Aerospace Material Specifications:

AMS 2242 - Tolerances, Corrosion and Heat Resistant Steel, Iron Alloy, Titanium, and Titanium Alloy Sheet, Strip, and Plate
MAM 2242 - Tolerances, Metric, Corrosion and Heat Resistant Steel, Iron Alloy, Titanium, and Titanium Alloy Sheet, Strip, and Plate
AMS 2248 - Chemical Check Analysis Limits, Wrought Corrosion and Heat Resistant Steels and Alloys, Maraging and Other Highly-Alloyed Steels, and Iron 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

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 E353 - Chemical Analysis of Stainless, Heat-Resisting, Maraging, and Other Similar Chromium-Nickel-Iron 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 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 or by spectrochemical or other analytical methods approved by purchaser:

| | min | max |
|---|---|---|
| Carbon | -- | 0.09 |
| Manganese | -- | 1.00 |
| Silicon | -- | 1.00 |
| Phosphorus | -- | 0.040 |
| Sulfur | -- | 0.030 |
| Chromium | 14.00 | 16.00 |
| Nickel | 6.50 | 7.75 |
| Molybdenum | 2.00 | 3.00 |
| Aluminum | 0.75 | 1.50 |



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).

3.2.3 Plate: Hot rolled, solution heat treated, and descaled.

3.3 Solution Heat Treatment: The product shall be solution heat treated by heating to 1950°F ± 25 (1065°C ± 15), holding at heat for not less than 3 min. per 0.1 inch (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: Shall be as follows:

| | |
|---|---|
| Tensile Strength, max | 150,000 psi (1035 MPa) |
| Yield Strength at 0.2% Offset, max | 65,000 psi ( 450 MPa) |
| Elongation in 2 in. (50 mm) or 4D, min | 25% |

3.4.1.2 Hardness: Should be not higher than 100 HRB, or equivalent, but the product shall not be rejected on the basis of hardness if the tensile property requirements of 3.4.1.1 are met.

3.4.1.3 Bending: Product 0.275 in. (7.00 mm) and under in nominal thickness shall withstand, without cracking, bending through the angle indicated below around a diameter equal to the bend factor times 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.

| Nominal Thickness | | Type of Bend | Angle deg, min | Bend Factor |
|---|---|---|---|---|
| Inch | Millimetres | | | |
| Up to 0.187, incl | Up to 4.75, incl | Free Bend | 180 | 1 |
| | | V-Block | 135 | 1 |
| Over 0.187 to 0.275, incl | Over 4.75 to 7.00, incl | Free Bend | 180 | 3 |
| | | V-Block | 135 | 3 |

3.4.1.3.1 Bending requirements for plate over 0.275 in. (7.00 mm) in nominal thickness shall be as agreed upon by purchaser and vendor.

3.4.2 As Austenite Conditioned and Precipitation Heat Treated: The product shall have the following properties after being austenite conditioned by heating to 1400°F ± 25 (760°C ± 15), holding at heat for 90 min. ± 5, cooling to 55°F ± 5 (15°C ± 3) within 60 min., holding at that temperature for not less than 30 min., and precipitation heat treated by heating to 1050°F ± 10 (565°C ± 5), holding at heat for 90 min. ± 5, and cooling to room temperature:

3.4.2.1 Product 0.0015 to 0.500 In. (0.038 to 12.50 mm), Incl, in Nominal Thickness:

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

TABLE I

| Nominal Thickness Inch | Tensile Strength psi, min | Yield Strength at 0.2% Offset psi, min | Elongation in 2 in. or 4D %, min |
|---|---|---|---|
| 0.0015 to 0.005, excl | 190,000 | 170,000 | 2 |
| 0.005 to 0.010, excl | 190,000 | 170,000 | 3 |
| 0.010 to 0.020, excl | 190,000 | 170,000 | 4 |
| 0.020 to 0.1875, excl | 190,000 | 170,000 | 5 |
| 0.1875 to 0.500, incl | 190,000 | 170,000 | 6 |

TABLE I (SI)

| Nominal Thickness Millimetres | Tensile Strength MPa, min | Yield Strength at 0.2% Offset MPa, min | Elongation in 50 mm or 4D %, min |
|---|---|---|---|
| 0.038 to 0.12, excl | 1310 | 1175 | 2 |
| 0.12 to 0.25, excl | 1310 | 1175 | 3 |
| 0.25 to 0.50, excl | 1310 | 1175 | 4 |
| 0.50 to 4.75, excl | 1310 | 1175 | 5 |
| 4.75 to 12.50, incl | 1310 | 1175 | 6 |

3.4.2.1.2 Hardness: Should be not lower than 40 HRC, or equivalent, but the product shall not be rejected on the basis of hardness if the tensile property requirements of 3.4.2.1.1 are met.

3.4.2.2 Product Over 0.500 In. (12.50 mm) in Nominal Thickness: Tensile property and hardness requirements shall be as agreed upon by purchaser and vendor.

3.4.3 As Austenite Conditioned, Sub-Zero Transformed, and Precipitation Heat Treated: The product shall have the following properties after being austenite conditioned by heating to 1750°F ± 25 (955°C ± 15), holding at heat for not less than 10 min., rapidly cooling to room temperature, sub-zero transformed by cooling to -100°F ± 10 (-75°C ± 5), holding at that temperature for not less than 8 hr, warming in air to room temperature, and precipitation heat treated by heating to 950°F ± 10 (510°C ± 5), holding at heat for 60 min. ± 5, and cooling to room temperature:

3.4.3.1 Product 0.0015 to 0.500 In. (0.038 to 12.50 mm), Incl, in Nominal Thickness:

3.4.3.1.1 Tensile Properties: Shall be as specified in Table II.

TABLE II

| Nominal Thickness Inch | Tensile Strength psi, min | Yield Strength at 0.2% Offset psi, min | Elongation in 2 in. or 4D %, min |
|---|---|---|---|
| 0.0015 to 0.005, excl | 225,000 | 200,000 | 1 |
| 0.005 to 0.010, excl | 225,000 | 200,000 | 2 |
| 0.010 to 0.020, excl | 225,000 | 200,000 | 3 |
| 0.020 to 0.1875, excl | 225,000 | 200,000 | 4 |
| 0.1875 to 0.500, incl | 225,000 | 200,000 | 5 |

TABLE II (SI)

| Nominal Thickness Millimetres | Tensile Strength MPa, min | Yield Strength at 0.2% Offset MPa, min | Elongation in 50 mm or 4D %, min |
|---|---|---|---|
| 0.038 to 0.12, excl | 1590 | 1440 | 1 |
| 0.12 to 0.25, excl | 1590 | 1440 | 2 |
| 0.25 to 0.50, excl | 1590 | 1440 | 3 |
| 0.50 to 4.75, excl | 1590 | 1440 | 4 |
| 4.75 to 12.50, incl | 1590 | 1440 | 5 |

3.4.3.1.2 Hardness: 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 of 3.4.3.1.1 are met.

3.4.3.2 Product Over 0.500 In. (12.50 mm) in Nominal Thickness: Tensile property and hardness requirements shall be as agreed upon by purchaser and vendor.

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.

3.6 Tolerances: Shall conform to all applicable requirements of AMS 2242 or MAM 2242.

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 4.4. Purchaser reserves the right to sample and to perform any confirmatory testing deemed 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 requirements for composition (3.1), tensile properties as solution heat treated (3.4.1.1) and as austenite conditioned and precipitation heat treated (3.4.2.1.1), and tolerances (3.6) are classified as acceptance tests and shall be performed on each heat or lot as applicable.

4.2.2 Periodic Tests: Tests to determine conformance to requirements for bending as solution heat treated (3.4.1.3), hardness (3.4.1.2, 3.4.2.1.2, and 3.4.3.1.2), and tensile properties as austenite conditioned, sub-zero transformed, and precipitation heat treated (3.4.3.1.1) are classified as periodic tests and shall be performed at a frequency selected by the vendor unless frequency of testing is specified by purchaser.

4.3 Sampling: Shall be in accordance with AMS 2371.

4.4 Reports:

4.4.1 The vendor of the product shall furnish with each shipment 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 and, when performed, to the periodic test requirements. This report shall include the purchase order number, heat number, AMS 5520C, size, and quantity.

4.4.2 The vendor of finished or semi-finished parts shall furnish with each shipment a report showing the purchase order number, AMS 5520C, 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 either a statement that the material conforms or 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, strip, and plate shall be marked on one face, in the respective location indicated below, with AMS 5520C, heat number, manufacturer's identification, and nominal thickness. The characters shall be of such size as to be 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. (150 mm) and Under in Width: Shall be marked in one or more lengthwise rows of characters recurring at intervals not greater than 3 ft (900 mm).