



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

AEROSPACE MATERIAL SPECIFICATION

AMS 5595B

Superseding AMS 5595A

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UNS S21904

STEEL SHEET, STRIP, AND PLATE, CORROSION RESISTANT
9.0Mn - 20Cr - 6.5Ni - 0.27N

1. SCOPE:

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

1.2 Application: Primarily for parts requiring high strength and corrosion resistance from -423° F to +1100° F (-255° to +595° C) 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 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

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

ASTM A370 - Mechanical Testing of Steel Products

ASTM A708 - Detection of Susceptibility to Intergranular Corrosion in Severely Sensitized Austenitic Stainless Steel

ASTM E112 - Estimating the Average Grain Size of Metals

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

2.3.2 Military Standards:

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

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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	--	0.04
Manganese	8.00 -	10.00
Silicon	--	1.00
Phosphorus	--	0.060
Sulfur	--	0.030
Chromium	19.00 -	21.50
Nickel	5.50 -	7.50
Nitrogen	0.15 -	0.40

- 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 unless solution heat treatment is performed in an atmosphere yielding a bright finish (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 $1950^{\circ}\text{F} \pm 25$ ($1065^{\circ}\text{C} \pm 15$), holding at heat for 3 min. for each 0.10 in. or 2.5 mm of nominal thickness, and cooling at a rate equivalent to rapid air cool or faster.

- 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 Grain Size: Shall be predominantly 7 or finer, determined by comparison of a polished and etched specimen with the chart in ASTM E112.

- 3.4.2 Tensile Properties:

TABLE I

Nominal Thickness Inches	Tensile Strength psi, min	Yield Strength at 0.2% Offset psi, min	Elongation in 2 in. or 4D %, min
Up to 0.1875, incl	100,000	60,000	40
0.1875 and over	90,000	50,000	40

TABLE I (SI)

Nominal Thickness Millimetres	Tensile Strength MPa, min	Yield Strength at 0.2% Offset MPa, min	Elongation in 50.8 mm or 4D %, min
Up to 4.762, incl	690	414	40
4.762 and over	621	345	40

3.4.3 Hardness: Shall be not higher than 100 HRB or equivalent.

3.4.4 Bending: Product 0.749 in. (19.02 mm) and under in nominal thickness shall withstand, without cracking, bending through the angle indicated in Table II 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. Bend requirements for product over 0.749 in. (19.02 mm) in nominal thickness shall be as agreed upon by purchaser and vendor. 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.

TABLE II

Nominal Thickness		Type of Bend	Angle	
Inch	(Millimetres)		deg, min	Bend Factor
Up to 0.249, incl	(Up to 6.32, incl)	Free Bend	180	1
Up to 0.249, incl	(Up to 6.32, incl)	V-Block	135	1
Over 0.249 to 0.749, incl	(Over 6.32 to 19.02, incl)	Free Bend	90	1
Over 0.249 to 0.749, incl	(Over 6.32 to 19.02, incl)	V-Block	135	2

3.4.5 Embrittlement: The product, after being sensitized by heating in air to $1250^{\circ}\text{F} \pm 10$ ($675^{\circ}\text{C} \pm 5$), holding at heat for 60 min. ± 5 , and cooling in air, shall show no evidence of intercrystalline surface attack when immersed in acidified copper sulfate solution in accordance with ASTM A708. After immersion, specimens shall withstand, without cracking, bending in accordance with ASTM A708.

3.5 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.

3.6 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:

4.2.1 Acceptance Tests: Tests to determine conformance to composition (3.1), grain size (3.4.1), tensile property (3.4.2), hardness (3.4.3), bending (3.4.4), and tolerance (3.6) requirements are classified as acceptance tests.

4.2.2 Periodic Tests: Tests to determine conformance to embrittlement (3.4.5) requirements are classified as periodic tests.

4.3 Sampling: Shall be in accordance with AMS 2371 and the following:

4.3.1 Specimens for tensile testing 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 for grain size, tensile properties, and hardness of each size from each heat. 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, strip, and plate shall be marked on one face, in the respective location indicated below, with AMS 5595B, 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, and Plate: 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.

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.

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.

6. ACKNOWLEDGMENT: A vendor shall mention this specification number and its revision letter in all quotations and when acknowledging purchase orders.

7. REJECTIONS: Material not conforming to this specification or to authorized modifications will be subject to rejection.

8. NOTES:

8.1 Marginal Indicia: The phi (ϕ) symbol is used to indicate technical changes from the previous issue of this specification.