

**AEROSPACE
MATERIAL
SPECIFICATION**

AMS 5532D
Superseding AMS 5532C

Issued 9-1-47
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ALLOY SHEET, STRIP, AND PLATE, CORROSION AND HEAT RESISTANT
30Fe - 21Cr - 20Ni - 20Co - 3.0Mo - 2.5W - 1.0 (Cb+Ta) - 0.15N
Solution Heat Treated UNS R30155

1. SCOPE:

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

1.2 Application: Primarily for parts requiring high strength up to 1500°F (815°C) and oxidation resistance up to 1800°F (980°C).

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 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

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

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

ASTM E8 - Tension Testing of Metallic Materials

ASTM E139 - Conducting Creep, Creep-Rupture, and Stress-Rupture Tests of Metallic Materials

ASTM E290 - Semi-Guided Bend Test for Ductility of Metallic Materials

ASTM E354 - Chemical Analysis of High-Temperature, Electrical, Magnetic, and Other Similar Iron, Nickel, and Cobalt Alloys

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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

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	0.08	0.16
Manganese	1.00	2.00
Silicon	--	1.00
Phosphorus	--	0.040
Sulfur	--	0.030
Chromium	20.00	22.50
Nickel	19.00	21.00
Cobalt	18.50	21.00
Molybdenum	2.50	3.50
Tungsten	2.00	3.00
Columbium + Tantalum	0.75	1.25
Nitrogen	0.10	0.20
Copper	--	0.50
Iron	remainder	

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 and Strip: Hot or cold rolled, solution heat treated, and, unless solution heat treatment is performed in an atmosphere yielding a bright finish, descaled, having a surface appearance comparable to a commercial corrosion-resistant steel No. 2D finish.

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

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

3.3.1 Tensile Properties: Shall be as follows, determined in accordance with ASTM E8:

Tensile Strength	100,000 - 140,000 psi (690 - 965 MPa)
Elongation in 2 in. (50 mm) or 4D, min	40%

3.3.2 Bending: Product 0.187 in. (4.75 mm) and under in nominal thickness shall withstand, without cracking, bending in accordance with ASTM E290 through an angle of 180 deg 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.

Nominal Thickness		Bend Factor
Inch	Millimetres	
Up to 0.050, incl	Up to 1.25, incl	1
Over 0.050 to 0.125, incl	Over 1.25 to 3.00, incl	2
Over 0.125 to 0.187, incl	Over 3.00 to 4.75, incl	3

3.3.2.1 Bending requirements for product over 0.187 in. (4.75 mm) in nominal thickness shall be as agreed upon by purchaser and vendor.

3.3.3 Stress-Rupture Properties at 1500°F (815°C): A tensile specimen, maintained at 1500°F $\pm$ 3 (815°C $\pm$ 2) while a load sufficient to produce an initial axial stress of 18,000 psi (125 MPa) is applied continuously, shall not rupture in less than 24 hours. The test shall be continued to rupture without change of load. Elongation after rupture, measured at room temperature, shall be not less than 10% in 2 in. (50 mm) or 4D. Tests shall be conducted in accordance with ASTM E139.

3.3.3.1 The test of 3.3.3 may be conducted using a load higher than required to produce an initial axial stress of 18,000 psi (125 MPa) but load shall not be changed while test is in progress. Time to rupture and elongation requirements shall be as specified in 3.3.3.

3.3.3.2 When permitted by purchaser, the test of 3.3.3 may be conducted using incremental loading. In such case, the load required to produce an initial axial stress of 18,000 psi (125 MPa) shall be maintained to rupture or for 24 hr, whichever occurs first. After the 24 hr and at intervals of 8 - 16 hr, preferably 8 - 10 hr, thereafter, the stress shall be increased in increments of 2,000 psi (15 MPa). Time to rupture and elongation requirements shall be as specified in 3.3.3.

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.

3.5 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 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: Tests to determine conformance to all technical requirements of this specification are classified as acceptance tests and shall be performed on each heat or lot as applicable.
- 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 three copies of a report showing the results of tests for chemical composition of each heat and for the tensile, bending, and stress-rupture properties of each lot. This report shall include the purchase order number, heat number, AMS 5532D, 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, AMS 5532D, 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 5532D, 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).