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400 COMMONWEALTH DRIVE, WARRENDALE, PA 15096

AEROSPACE MATERIAL SPECIFICATION

Submitted for recognition as an American National Standard

AMS 5549E

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Superseding AMS 5549D

STEEL PLATE, CORROSION AND MODERATE HEAT RESISTANT 15.5Cr - 4.5Ni - 2.9Mo - 0.10N Solution Heat Treated

UNS S35500

1. SCOPE:

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

1.2 Application: Primarily for parts requiring oxidation resistance and high strength up to 800°F (425°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 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 Steel 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

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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 spectrographic or other analytical methods approved by purchaser:

	min		max
Carbon	0.10	-	0.15
Manganese	0.50	-	1.25
Silicon	--	-	0.50
Phosphorus	--	-	0.040
Sulfur	--	-	0.030
Chromium	15.00	-	16.00
Nickel	4.00	-	5.00
Molybdenum	2.50	-	3.25
Nitrogen	0.07	-	0.13

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

3.2 Condition: Hot rolled, solution heat treated free from continous carbide network, and descaled.

3.3 Solution Heat Treatment: The product shall be solution heat treated by heat to 1900°F + 25 (1040°C + 15), holding at heat for 1 - 3 hr, and quenching in water or otherwise cooling as rapidly as possible to room temperature.

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

3.4.1 As Solution Heat Treated:

3.4.1.1 Ø Bending: Plate 0.750 in. (18.75 mm) and under in nominal thickness shall withstand, without cracking, bending at room temperature through the angle shown below around a diameter equal to three times the nominal thickness of the plate with axis of bend parallel to the direction of rolling:

Nominal Diameter		Angle
Inches	Millimetres	deg, min
Over 0.187 to 0.249, incl	Over 4.75 to 6.25, incl	130
Over 0.249 to 0.750, incl	Over 6.25 to 18.75, incl	90

3.4.1.2 Bending requirements for plate over 0.750 in. (18.75 mm) in nominal thickness shall be as agreed upon by purchaser and vendor.

3.4.2 As Re-Solution Heat Treated, Sub-Zero Cooled, Austenite Conditioned, Sub-Zero Cooled, and Tempered: The product shall conform to the following requirements after being heat treated as follows: Re-solution heat treat by heating to 1900°F ± 25 (1040°C ± 15), holding at heat for 1 - 3 hr, and quenching in water; cool to -100°F (-75°C) or colder, hold at this temperature for not less than 3 hr, and warm in air to room temperature; austenite condition by heating to 1750°F ± 10 (955°C ± 5), holding at heat for 10 - 60 min., and quenching in water; cool to -100°F (-75°C) or colder, hold at this temperature for not less than 3 hr, and warm in air to room temperature; temper by heating to 1000°F ± 25 (540°C ± 5), holding at heat for not less than 3 hr, and cooling in air:

3.4.2.1 Tensile Properties:

Tensile Strength, min	165,000 psi (1140 MPa)
Yield Strength at 0.2% Offset, min	140,000 psi (965 MPa)
Elongation in 2 in. (50 mm), min	12%

3.4.2.2 Hardness: Should be 37 - 44 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 are met.

3.5 Quality:

3.5.1 Ø Steel shall be multiple melted using consumable electrode practice in the remelt cycle, using only one electrode to produce a single ingot.

3.5.2 The product, as received by purchaser, shall be uniform in quality and condition, free of grain boundary carbides, sound, and free from foreign materials and from imperfections detrimetnal to usage of the product.

3.6 Tolerances: Shall conform to all applicable requirements of AMS 2242 or MAM 2242. Flatness tolerances shall be as agreed upon by purchaser and vendor.

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; a heat shall be the consumable electrode remelted ingots from steel originally melted as a single furnace charge.

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 for tensile properties and hardness of each lot. This report shall include the purchase order number, heat number, AMS 5549E, 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 5549E, 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 plate shall be marked on one face in lengthwise rows of characters recurring at intervals not greater than 3 ft (900 mm), the rows being spaced not more than 6 in. (150 mm) apart and alternately staggered, with AMS 5549E, 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.

5.2 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.