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SAE-AMS5604, "STEEL, CORROSION RESISTANT, SHEET, STRIP, AND PLATE 16.5CR - 4.0NI - 4.0CU - 0.30CB SOLUTION HEAT TREATED, PRECIPITATION HARDENABLE", was adopted on 17-MAR-89 for use by the Department of Defense (DoD). Proposed changes by DoD activities must be submitted to the DoD Adopting Activity: Commander, Defense Supply Center Philadelphia, ATTN: DSCP-ILEA, 700 Robbins Avenue, Philadelphia, PA 19111-5096. Copies of this document may be purchased from the Society of Automotive Engineers 400 Commonwealth Drive Warrendale, Pennsylvania, United States, 15096-0001. http://www.sae.org/

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AEROSPACE MATERIAL SPECIFICATION

An American National Standard

SAE AMS 5604D

Issued MAY 1968
Revised MAY 1995

Superseding AMS 5604C

STEEL, CORROSION RESISTANT, SHEET, STRIP, AND PLATE
16.5Cr - 4.0Ni - 4.0Cu – 0.30Cb
Solution Heat Treated, Precipitation Hardenable

UNS S17400

1. SCOPE:

1.1 Form:

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

1.2 Application:

These products have been used typically for parts requiring corrosion resistance and high strength up to 600 °F (316 °C) and where such parts may require welding during fabrication, but usage is not limited to such applications.

1.2.1 Certain processing procedures and service conditions may cause these products to become 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 SAE publications shall apply. The applicable issue of other publications shall be the issue in effect on the date of the purchase order.

2.1 SAE Publications:

Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

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

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2.1 (Continued):

AMS 2248 Chemical Check Analysis Limits, Wrought Corrosion and Heat Resistant Steels and Alloys, Maraging and Other Highly-Alloyed Steels, and Iron Alloys
AMS 2315 Determination of Delta Ferrite Content
AMS 2371 Quality Assurance Sampling and Testing, Corrosion and Heat Resistant Steels and Alloys, Wrought Products and Forging Stock
AMS 2750 Pyrometry
AMS 2807 Identification, Carbon and Low-Alloy Steels, Corrosion and Heat Resistant Steels and Alloys, Sheet, Strip, Plate, and Aircraft Tubing

ARP1110 Minimizing Stress-Corrosion Cracking in Wrought Forms of Steels and Corrosion Resistant Steels and Alloys

2.2 ASTM Publications:

Available from ASTM, 1916 Race Street, Philadelphia, PA 19103-1187.

ASTM A 370 Mechanical Testing of Steel Products
ASTM E 353 Chemical Analysis of Stainless, Heat-Resisting, Maraging, and Other Similar Chromium-Nickel-Iron Alloys

2.3 U.S. Government Publications:

Available from DODSSP, Subscription Services Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.

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

3. TECHNICAL REQUIREMENTS:

3.1 Composition:

(R)

Shall conform to the percentages by weight shown in Table 1, determined by wet chemical methods in accordance with ASTM E 353, by spectrochemical methods, or by other analytical methods acceptable to purchaser.

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TABLE 1 - Composition

Element	min	max
Carbon	--	0.07
Manganese	--	1.00
Silicon	--	1.00
Phosphorus	--	0.040
Sulfur	--	0.030
Chromium	15.00	17.50
Nickel	3.00	5.00
Columbium	5xC	0.45
Copper	3.00	5.00
Molybdenum	--	0.50

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 and Strip: 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 No. 2D finish (See 8.2).

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

3.3 Solution Heat Treatment:

(R)

The product shall be solution heat treated by heating to 1900 °F ± 25 (1038 °C ± 14), holding at heat for a time commensurate with the thickness and the heating equipment and procedure used, and cooling to below 90 °F (32 °C). Pyrometry shall conform to AMS 2750.

3.4 Properties:

The product shall conform to the following requirements; tensile, hardness, and bend testing shall be performed in accordance with ASTM A 370:

3.4.1 As Solution Heat Treated:

3.4.1.1 Tensile Properties: Shall be as shown in Table 2 for nominal thickness 0.015 to 0.1874 inch (0.38 to 4.760 mm), inclusive.

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TABLE 2 - Solution Treated Tensile Properties

Property	Value
Tensile Strength, max	185 ksi (1276 MPa)
Yield Strength at 0.2% Offset, max	160 ksi (1103 MPa)
Elongation in 2 Inches (50.8 mm), min	3%

3.4.1.2 Hardness: Shall be not higher than 38 HRC, or equivalent (See 8.3).

3.4.1.3 Microstructure: The product shall contain not more than 5% ferrite, determined in accordance with AMS 2315.

3.4.1.4 Bending: Product 0.109 inch (2.77 mm) and under in nominal thickness shall withstand, without cracking, bending through an angle of 180 degrees around a diameter equal to 18 times the nominal thickness of the product with axis of bend parallel to the direction of rolling.

3.4.2 After Precipitation Heat Treatment: The solution heat treated product 4.0 inches (102 mm) and under in nominal thickness shall have tensile properties specified in 3.4.2.1 and hardness specified in 3.4.2.2 after being precipitation heat treated to a particular condition in accordance with the corresponding temperature and times shown in Table 3 and cooled as required. Tensile and hardness tests shall be made in only the H900 condition unless purchaser specifies another heat treated condition.

TABLE 3 - Precipitation Hardening Conditions

Condition	Temperature	Time
H900	900 °F ± 10 (482 °C ± 6)	60 minutes ± 5
H925	925 °F ± 10 (496 °C ± 6)	4 hours ± 0.25
H1025	1025 °F ± 10 (552 °C ± 6)	4 hours ± 0.25
H1075	1075 °F ± 10 (579 °C ± 6)	4 hours ± 0.25
H1100	1100 °F ± 10 (593 °C ± 6)	4 hours ± 0.25
H1150	1150 °F ± 10 (621 °C ± 6)	4 hours ± 0.25

3.4.2.1 Tensile Properties: Shall be as shown in Table 4.

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TABLE 4A - Minimum Tensile Properties After Precipitation Heat Treatment, Inch/Pound Units

Condition	Nominal Thickness Inches	Tensile Strength ksi	Yield Strength at 0.2% Offset ksi	Elongation in 2 Inches or 4D %	Reduction of Area %
H900	Up to 0.1874, incl	190	170	5	--
	0.1875 to 0.625, incl	190	170	8	30
	Over 0.625 to 4.000, incl	190	170	10	35
H925	Up to 0.1874, incl	170	155	5	--
	0.1875 to 0.625, incl	170	155	8	30
	Over 0.625 to 4.000, incl	170	155	10	35
H1025	Up to 0. 1874, incl	155	145	5	--
	0.1875 to 0.625, incl	155	145	8	35
	Over 0.625 to 4.000, incl	155	145	12	40
H1075	Up to 0.1874, incl	145	125	5	--
	0.1875 to 0.625, incl	145	125	9	35
	Over 0.625 to 4.000, incl	145	125	13	45
H1100	Up to 0.1874, incl	140	115	5	--
	0.1875 to 0.625, incl	140	115	10	35
	Over 0.625 to 4.000, incl	140	115	14	45
H1150	Up to 0.1874, incl	135	105	8	--
	0.1875 to 0.625, incl	135	105	10	40
	Over 0.625 to 4.000, incl	135	105	16	50

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TABLE 4B - Minimum Tensile Properties After Precipitation Heat Treatment, SI Units

Condition	Nominal Thickness Millimeters	Tensile Strength MPa	Yield Strength at 0.2% Offset MPa	Elongation in 50.8 mm or 4D %	Reduction of Area %
H900	Up to 4.760, incl	1310	1172	5	--
	4.761 to 15.88, incl	1310	1172	8	30
	Over 15.88 to 101.60, incl	1310	1172	10	35
H925	Up to 4.760, incl	1172	1069	5	--
	4.761 to 15.88, incl	1172	1069	8	30
	Over 15.88 to 101.60, incl	1172	1069	10	35
H1025	Up to 4.760, incl	1069	1000	5	--
	4.761 to 15.88, incl	1069	1000	8	35
	Over 15.88 to 101.60, incl	1069	1000	12	40
H1075	Up to 4.760, incl	1000	862	5	--
	4.761 to 15.88, incl	1000	862	9	35
	Over 15.88 to 101.60, incl	1000	862	13	45
H1100	Up to 4.760, incl	965	793	5	--
	4.761 to 15.88, incl	965	793	10	35
	Over 15.88 to 101.60, incl	965	793	14	45
H1150	Up to 4.760, incl	931	724	8	--
	4.761 to 15.88, incl	931	724	10	40
	Over 15.88 to 101.60, incl	931	724	16	50

3.4.2.2 Hardness: Shall be within the range shown in Table 5 for the corresponding precipitation heat treatment condition.

TABLE 5 - Hardness

Condition	HB	HRC	HV
H900	375 to 444	40 to 47	411 to 510
H925	352 to 415	38 to 45	392 to 473
H1025	331 to 388	35 to 42	364 to 431
H1075	311 to 363	33 to 39	344 to 401
H1100	302 to 352	32 to 38	333 to 392
H1150	269 to 341	28 to 37	280 to 383

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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; flatness tolerance for sheet shall be as specified for cold worked austenitic sheet in half-hard temper.

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. 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 (R) Acceptance Tests: Composition (3.1), tensile properties (3.4.1.1), hardness (3.4.1.2), and bending (3.4.1.4), precipitation heat treated tensile properties (3.4.2.1), and hardness (3.4.2.2), in the H900 precipitation hardened condition and tolerances (3.6) are acceptance tests and shall be performed on each heat or lot as applicable.

4.2.2 (R) Periodic Tests: Microstructure (3.4.1.3) and properties in other than the H900 precipitation hardened condition (3.4.2) are periodic tests and shall be performed at a frequency selected by the vendor unless frequency of testing is specified by the purchaser.

4.3 Sampling and Testing:
(R)

Shall be in accordance with AMS 2371.

4.4 Reports:
(R)

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 of 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, lot number, AMS 5604D, size, and quantity.

4.5 Resampling and Retesting:

Shall be in accordance with AMS 2371.

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