



AEROSPACE MATERIAL SPECIFICATION	AMS5874™	REV. D
	Issued 1980-07 Reaffirmed 2018-10 Revised 2023-10	
Superseding AMS5874C		
Alloy, Corrosion- and Heat-Resistant, Sheet, Strip, and Plate 29Fe - 22Cr - 21Ni - 18.5Co - 3.2Mo - 2.8W - 0.78Ta - 0.30Al - 0.05Zr - 0.05La - 0.20N (HS-556) Solution Heat Treated (Composition similar to UNS R30556)		

RATIONALE

AMS5874D is the result of a Five-Year Review and update of the specification. The revision updates composition testing and reporting (see 3.1 and 3.1.1), invokes a new specification for sheet finish (see 3.2.1), adds pyrometry controls and requirements for continuous heat treatment (see 3.3 and 3.3.1), adds strain rate control during tensile testing (see 3.4.2.1), allows incremental loading during testing (see 3.4.5.2), updates tolerances (see 3.6), prohibits unauthorized exceptions (see 3.7, 4.5.1, 5.1.1, and 8.5), adds country of origin requirements (see 4.5), and allows prior revisions (see 8.4).

1. SCOPE

1.1 Form

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

1.2 Application

These products have been used typically for formed, drawn, and welded parts requiring high strength and oxidation resistance up to 2000 °F (1093 °C), but usage is not limited to such applications.

2. APPLICABLE DOCUMENTS

The issue of the following documents in effect on the date of the purchase order forms a part of this specification to the extent specified herein. The supplier may work to a subsequent revision of a document unless a specific document issue is specified. When the referenced document has been cancelled and no superseding document has been specified, the last published issue of that document shall apply.

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2.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or +1 724-776-4970 (outside USA), www.sae.org.

AMS2248	Chemical Check Analysis Limits, Corrosion- and Heat-Resistant Steels and Alloys, Maraging and Other Highly Alloyed Steels, and Iron Alloys
AMS2262	Tolerances, Nickel, Nickel Alloy, and Cobalt Alloy Sheet, Strip, and Plate
AMS2283	Composition Testing Methods for Nickel- and Cobalt-Based Alloys
AMS2371	Quality Assurance Sampling and Testing, Corrosion and Heat-Resistant Steels and Alloys, Wrought Products and Forging Stock
AMS2750	Pyrometry
AMS2807	Identification, Carbon and Low-Alloy Steels, Corrosion and Heat-Resistant Steels and Alloys Sheet, Strip, Plate, and Aircraft Tubing
AS4194	Sheet and Strip Surface Finish Nomenclature
AS7766	Terms Used in Aerospace Metals Specifications

2.2 ASTM Publications

Available from ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959, Tel: 610-832-9585, www.astm.org.

ASTM B906	General Requirements for Flat-Rolled Nickel and Nickel Alloys Plate, Sheet, and Strip
ASTM E8/E8M	Tension Testing of Metallic Materials
ASTM E18	Rockwell Hardness Hardness of Metallic Materials
ASTM E112	Determining Average Grain Size
ASTM E139	Conducting Creep, Creep-Rupture, and Stress-Rupture Tests of Metallic Materials
ASTM E140	Hardness Conversion Tables for Metals Relationship Among Brinell Hardness, Vickers Hardness, Rockwell Hardness, Superficial Hardness, Knoop Hardness, Scleroscope Hardness, and Leeb Hardness
ASTM E290	Bend Testing of Material for Ductility

2.3 Definitions

Terms used in AMS are defined in AS7766.

3. TECHNICAL REQUIREMENTS

3.1 Composition

Composition shall conform to the percentages by weight shown in Table 1, determined in accordance with AMS2283 or by other analytical methods acceptable to the purchaser.

Table 1 - Composition

Element	Min	Max
Carbon	0.05	0.15
Manganese	0.50	2.00
Silicon	0.20	0.80
Phosphorus	--	0.04
Sulfur	--	0.015
Chromium	21.00	23.00
Nickel	19.00	22.50
Cobalt	16.00	21.00
Molybdenum	2.50	4.00
Tungsten	2.00	3.50
Tantalum	0.30	1.25
Aluminum	0.10	0.50
Zirconium	0.001	0.10
Lanthanum	0.005	0.10
Nitrogen	0.10	0.30
Columbium (Niobium)	--	0.30
Boron	--	0.02
Iron	remainder	

3.1.1 The producer may test for any element not listed in Table 1 and include this analysis in the report of 4.5. Reporting of any element not listed in the composition table is not a basis for rejection unless limits of acceptability are specified by the purchaser.

3.1.2 Check Analysis

Composition variations shall meet the requirements of AMS2248; check analysis limits for lanthanum shall be 0.002 under minimum and 0.01 over maximum.

3.2 Condition

The product shall be supplied in the following condition:

3.2.1 Sheet and Strip

Sheet and strip shall be hot or cold rolled, solution heat treated, and, unless solution heat treatment is performed in a protective atmosphere yielding a bright finish, descaled having a surface appearance in accordance with ASTM B906 and AS4194 comparable to 3.2.1.1 and 3.2.1.2 as applicable.

3.2.1.1 Sheet shall have a No. 2D finish.

3.2.1.2 Strip shall have a No. 1 strip finish.

3.2.2 Plate

Plate shall be hot rolled, solution heat treated, and descaled.

3.3 Heat Treatment

The product shall be solution heat treated by heating to a temperature within the range 2100 to 2225 °F (1149 to 1218 °C), holding at the selected temperature within ± 25 °F (± 14 °C) for a time commensurate with section thickness but not more than 30 minutes, and cooling rapidly. Pyrometry shall be in accordance with AMS2750.

3.3.1 Continuous Heat Treatment:

When continuous heat treating is used process parameters (e.g., furnace temperature set points, heat input, travel rate, etc.) for continuous heat treating lines shall be established by the material producer and validated by testing of product to the requirements of 3.4.

3.4 Properties

The product shall conform to the following requirements:

3.4.1 Average Grain Size

Average grain size shall be 3 or finer, determined by comparison of a polished and etched specimen with the chart in ASTM E112.

3.4.2 Tensile Properties

Tensile properties shall be as shown in Table 2, determined in accordance with ASTM E8/E8M.

Table 2 - Minimum tensile properties

Property	Value
Tensile Strength	100 ksi (689 MPa)
Yield Strength at 0.2% Offset	47.0 ksi (324 MPa)
Elongation in 2 Inches (50 mm) or 4D Nominal Thickness	
Up to 0.020 inch (0.51 mm), incl	35%
Over 0.020 inch (0.51 mm)	40%

3.4.2.1 Unless otherwise specified, the strain rate shall be set at 0.005 in/in/min (0.005 mm/mm/min) and maintained within a tolerance of ± 0.002 in/in/min (± 0.002 mm/mm/min) through 0.2% offset yield strain. After the yield strain, the speed of the testing machine shall be set between 0.05 in/in and 0.5 in/in (0.05 mm/mm and 0.5 mm/mm) of the length of the reduced parallel section (or distance between the grips for specimens not having a reduced section) per minute. Alternatively, an extensometer and strain rate indicator may be used to set the strain rate between 0.05 in/in/min and 0.5 in/in/min (0.05 mm/mm/min and 0.5 mm/mm/min). The requirement for compliance becomes effective for material produced 1 year after the publication date of this specification.

3.4.3 Hardness

Hardness shall be not higher than 21 HRC, or equivalent (see 8.2), determined in accordance with ASTM E18.

3.4.4 Bending

Product 0.187 inch (4.75 mm) and under in nominal thickness shall be tested in accordance with ASTM E290 using a sample prepared nominally 0.75 inch (19.0 mm) in width with its axis of bending parallel to the direction of rolling and shall withstand, without cracking, when bending at room temperature through an angle of 180 degrees around a diameter equal to the bend factor shown in Table 3 times the nominal thickness of the product. In case of dispute, the results of tests using the guided bend test of ASTM E290 shall govern.

Table 3 - Bending parameters

Nominal Thickness Inches	Nominal Thickness Millimeters	Bend Factor
Up to 0.050, incl	Up to 1.27, incl	1.5
Over 0.050 to 0.187, incl	Over 1.27 to 4.75, incl	2.0

3.4.5 Stress-Rupture Properties at 1500 °F (816 °C)

A tensile specimen, maintained at 1500 °F ± 3 °F (816 °C ± 2 °C) while a load sufficient to produce the initial axial stress specified in Table 4 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 as specified in Table 4. Tests shall be conducted in accordance with ASTM E139.

Table 4 - Stress rupture parameters

Nominal Thickness Inches	Nominal Thickness Millimeters	Stress ksi	Stress MPa	Elongation in 2 Inches (50 mm) or 4D %, Min
Up to 0.020, incl	Up to 0.51, incl	18.0	124	20
Over 0.020	Over 0.51	19.0	131	25

3.4.5.1 The test of 3.4.5 may be conducted using a load higher than required to produce the initial axial stress specified in Table 4 but load shall not be changed while test is in progress. Time to rupture and elongation requirements shall be as specified in 3.4.5.

3.4.5.2 The test of 3.4.5 may be conducted using incremental loading. In such case, a load sufficient to produce the initial axial stress specified in Table 4 shall be used to rupture or for 24 hours, whichever occurs first. After the 24 hours and at intervals of 8 hours minimum, thereafter, the stress shall be increased in increments of 2.0 ksi (14 MPa). Time to rupture and elongation requirements shall be as specified in 3.4.5.

3.4.6 Oxidation Resistance

Specimens shall meet the following oxidation requirements, when tested in accordance with 3.4.6.3, 3.4.6.4, and 3.4.6.5:

3.4.6.1 Metal converted to oxide scale plus any continuous intergranular oxidation shall not exceed an average of 0.0015 inch (0.038 mm) per side or 0.003 inch (0.08 mm) per specimen.

3.4.6.2 Specimens displaying localized areas greater than 0.062 inch (1.57 mm) in diameter with excessive oxidation attack, unless such attack can be attributed to contact with ceramic supports, shall be considered invalid and the tests repeated. If the condition is duplicated, the product is not acceptable.

3.4.6.3 Specimen Preparation

Specimens shall have surface area not less than 1.5 square inches (9.7 cm²) available for exposure in excess of material required for fixturing. Both sides of the specimen shall have a 120-grit (125- μ m) surface finish. Specimen dimensions shall be measured to within ±0.0003 inch (±7.6 μ m). Specimens shall be degreased.

3.4.6.4 Testing

Specimens shall be exposed for four cycles, each cycle consisting of heating in air to 2000 °F ± 25 °F (1093 °C ± 14 °C), holding at heat for 25 hours ± 1 hour, and cooling in air to 300 °F (149 °C) or lower between each cycle, for a total of 100 hours ± 4 hours at heat. Specimens may be partially inserted into inert ceramic bricks or suspended from inert ceramic rods or suitable metallic rods, but shall not be placed in crucibles. The specimens may be tested in a muffle or comparable furnace provided that air flow is such that the required surface areas are equally exposed to the flowing air and temperature.