# AEROSPACE MATERIAL SPECIFICATION

| AMS5878 | REV. D |
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Superseding AMS5878C

# Nickel Alloy, Corrosion and Heat-Resistant, Sheet, Strip, and Plate
# 59Ni - 22Cr - 2Mo - 14W - 0.35Al - 0.03La
# Solution Heat Treated
# (Composition similar to UNS N06230)

RATIONALE

AMS5878D revises Heat Treatment (3.3), Properties (3.4.1), Reports (4.4, 4.4.5), and is a Five Year Review and update of this specification.

## 1. SCOPE

### 1.1 Form

This specification covers a corrosion and heat-resistant nickel alloy in the form of sheet, strip, and plate 0.015 to 1.5 inch (0.38 to 38 mm) in nominal thickness . (See 8.5).

### 1.2 Application

These products have been used typically for parts requiring oxidation resistance up to 2100 °F (1149 °C) and relatively high strength up to 1800 °F (982 °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.

### 2.1 SAE Publications

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

AMS2262 Tolerances, Nickel, Nickel Alloy, and Cobalt Alloy Sheet, Strip, and Plate

AMS2269 Chemical Check Analysis Limits, Nickel, Nickel Alloys, and Cobalt Alloys

AMS2371 Quality Assurance Sampling and Testing, Corrosion and Heat-Resistant Steels and Alloys, Wrought Products and Forging Stock

AMS2750 Pyrometry





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**http://www.sae.org/technical/standards/AMS5878D**

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

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 A 480/A 480M Flat-Rolled Stainless and Heat-Resistant Steel Plate, Sheet, and Strip

ASTM E 8/E 8M Tension Testing of Metallic Materials

ASTM E 18 Rockwell Hardness of Metallic Materials

ASTM E 112 Determining Average Grain Size

ASTM E 139 Conducting Creep, Creep-Rupture, and Stress-Rupture Tests of Metallic Materials

ASTM E 290 Bend Test of Materials for Ductility

ASTM E 354 Chemical Analysis of High-Temperature, Electrical, Magnetic, and Other Similar Iron, Nickel, and Cobalt Alloys

ASTM E 384 Knoop and Vickers Hardness of Materials

3. TECHNICAL REQUIREMENTS

3.1 Composition

Shall conform to the percentages by weight shown in Table 1, determined by wet chemical methods in accordance with ASTM E 354, by spectrochemical methods, or by other analytical methods acceptable to purchaser.

***TABLE 1 - Composition***

| Element | min | max |
|---|---|---|
| Carbon | 0.05 | 0.15 |
| Manganese | 0.30 | 1.00 |
| Silicon | 0.25 | 0.75 |
| Phosphorus | -- | 0.03 |
| Sulfur | -- | 0.015 |
| Chromium | 20.00 | 24.00 |
| Molybdenum | 1.00 | 3.00 |
| Tungsten | 13.00 | 15.00 |
| Aluminum | 0.20 | 0.50 |
| Lanthanum | 0.005 | 0.05 |
| Cobalt | -- | 5.00 |
| Titanium | -- | 0.10 |
| Boron | -- | 0.015 |
| Iron | -- | 3.00 |
| Copper | -- | 0.50 |
| Nickel | remainder | |

3.1.1 Check Analysis

Composition variations shall meet the applicable requirements of AMS2269.

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 the following commercial corrosion resistant steel finishes as described in ASTM A 480/A 480M and AS4194 and 3.2.1.1 or 3.2.1.2 as applicable.

3.2.1.1 Sheet

No. 2D finish.

3.2.1.2 Strip

No. 1 strip finish.

3.2.2 Plate

Hot rolled, solution heat treated, and descaled.

3.3 Heat Treatment

Pyrometry shall be in accordance with AMS2750. Except as specified in 3.3.1 the product shall be solution heat treated by heating to a temperature within the range 2150 to 2275 °F (1177 to 1246 °C), holding at the selected temperature within ±25 °F (±14 °C) for a time commensurate with section thickness, and cooling rapidly.

3.3.1 Continuous Heat Treating

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 other requirements of this specification.

3.4 Properties

Product 0.015 to 1.5 inch (0.38 to 38 mm) in nominal thickness shall conform to the following requirements:

3.4.1 Mechanical property requirements for product outside of the range covered by 1.1 shall be agreed upon between purchaser and producer.

3.4.2 Tensile Properties

Shall be as shown in Table 2, determined in accordance with ASTM E 8/E 8M.

***TABLE 2 - Minimum Tensile Properties***

| Property | Value |
|---|---|
| Tensile Strength | 115 ksi (793 MPa) |
| Yield Strength at 0.2% Offset | 50 ksi (345 MPa) |
| Elongation in 2 Inches (50.8 mm) or 4D | 40% |

3.4.3 Hardness

Shall be not higher than 25 HRC, or equivalent (See 8.2), determined in accordance with ASTM E 18. For thin gages where superficial hardness testing is impractical, microhardness testing in accordance with ASTM E 384 may be used. Product shall not be rejected on the basis of hardness if the tensile properties of 3.4.1 are acceptable, determined on specimens taken from the same sample as that with nonconforming hardness or from another sample with similar nonconforming hardness.

3.4.4 Average Grain Size

Shall be not larger than shown in Table 3, determined in accordance with ASTM E 112.

***TABLE 3 - Maximum Average Grain Size***

| Nominal Thickness Inch | Nominal Thickness Millimeters | ASTM Grain Size No. |
|---|---|---|
| 0.015 to 0.125, incl | 0.38 to 3.18, incl | 4 |
| Over 0.125 to 0.1874, incl | Over 3.18 to 4.760, incl | 3 |
| Over 0.1874 | Over 4.760 | 3 |

3.4.5 Stress-Rupture Properties at 1700 °F (927 °C)

A tensile specimen, maintained at 1700 °F ± 3 (927 °C ± 2) while a load sufficient to produce an initial axial stress of 9.0 ksi (62 MPa) or higher is applied continuously, shall not rupture in less than 36 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 inches (50.8 mm). Tests shall be conducted in accordance with ASTM E 139.

3.4.5.1 The test of 3.4.4 may be conducted using incremental loading. In such case, a load sufficient to produce an initial axial stress of 9.0 ksi (62 MPa) or higher shall be used to rupture or for 36 hours, whichever occurs first. After the 36 hours and at intervals of 8 hours minimum, thereafter, the stress shall be increased in increments of 1.0 ksi (6.9 MPa). Time to rupture and elongation requirements shall be as specified in 3.4.4.

3.4.6 Bending

Product shall be tested in accordance with ASTM E 290 using a sample prepared nominally 0.75 inch (19.0mm) in width with its axis of bending parallel to the direction of rolling and shall withstand, without cracking, bending at room temperature through an angle of 180 degrees around a diameter equal to the bend factor shown in Table 4 times the nominal thickness of the product. In the case of dispute, the results of tests using the guided bend test of ASTM E 290 shall govern.

***TABLE 4 - Bending Parameters***

| Nominal Thickness Inch | Nominal Thickness Millimeters | Bend Factor |
|---|---|---|
| Up to 0.050, incl | Up to 1.27, incl | 1.5 |
| Over 0.050 to 0.1874, incl | Over 1.27 to 4.760, incl | 2.0 |



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 AMS2262.

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 the performance of all required tests. Purchaser reserves the right to sample and to perform any confirmatory testing deemed necessary to ensure that the product conforms to specified requirements.

4.2 Classification of Tests

All technical requirements are acceptance tests and shall be performed on each heat or lot as applicable.