SAE Aerospace
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# AEROSPACE MATERIAL SPECIFICATION

SAE AMS 5878B

Issued JAN 1990
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Superseding AMS 5878A

## 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)



1. SCOPE:

1.1 Form:

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

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, 400 Commonwealth Drive, Warrendale, PA 15096-0001 or www.sae.org.

| | |
|---|---|
| AMS 2262 | Tolerances, Nickel, Nickel Alloy, and Cobalt Alloy Sheet, Strip, and Plate |
| MAM 2262 | Tolerances, Metric, Nickel, Nickel Alloy, and Cobalt Alloy Sheet, Strip, and Plate |
| AMS 2269 | Chemical Check Analysis Limits, Nickel, Nickel Alloys, and Cobalt Alloys |
| AMS 2371 | Quality Assurance Sampling and Testing, Corrosion and Heat-Resistant Steels and Alloys, Wrought Products and Forging Stock |



**TO PLACE A DOCUMENT ORDER:**
**Tel: 877-606-7323 (inside USA and Canada)**
**Tel: 724-776-4970 (outside USA)**
**Fax: 724-776-0790**
**Email: custsvc@sae.org**
**SAE WEB ADDRESS: http://www.sae.org**

2.1 (Continued):

| | |
|---|---|
| AMS 2750 | Pyrometry |
| AMS 2807 | 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, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959 or www.astm.org.

| | |
|---|---|
| ASTM A 480/A 480M | Flat-Rolled Stainless and Heat-Resistant Steel Plate, Sheet, and Strip |
| ASTM E 8 | Tension Testing of Metallic Materials |
| ASTM E 8M | Tension Testing of Metallic Materials (Metric) |
| ASTM E 18 | Rockwell Hardness and Rockwell Superficial 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 | Semi-Guided Bend Test for Ductility of Metallic Materials |
| ASTM E 354 | Chemical Analysis of High-Temperature, Electrical, Magnetic, and Other Similar Iron, Nickel, and Cobalt Alloys |
| ASTM E 384 | Microhardness 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 AMS 2269.

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 in accordance with ASTM A 480/A 480M and AS4194 comparable to 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:

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. Pyrometry shall be in accordance with AMS 2750.

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 Tensile Properties: Shall be as shown in Table 2, determined in accordance with ASTM E 8 or ASTM 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% |

3.4.2 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.

3.4.3 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 |

3.4.4 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.

3.4.4.1 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 to 16 hours, preferably 8 to 10 hours, 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.

3.4.5 Bending: Product shall withstand, without cracking, bending at room temperature in accordance with ASTM E 290 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, with axis of bend parallel to the direction of rolling.

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 AMS 2262 or MAM 2262.

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.

4.3 Sampling and Testing:

Shall be in accordance with AMS 2371.

4.4 Reports:

The vendor of the product shall furnish with each shipment a report showing the following results of tests and relevant information:

4.4.1 For each heat:

Composition.