



# AEROSPACE MATERIAL SPECIFICATIONS

SOCIETY OF AUTOMOTIVE ENGINEERS, Inc.

485 Lexington Ave., New York, N. Y. 10017

## AMS 5597A

Superseding AMS 5597

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### ALLOY SHEET, STRIP, AND PLATE, CORROSION AND HEAT RESISTANT

Nickel Base - 19Cr - 3.1Mo - 5.1(Cb + Ta) - 0.90Ti - 0.50Al

Consumable Electrode or Vacuum Induction Melted

1950 F (1065.6 C) Solution Treated

1. ACKNOWLEDGMENT: A vendor shall mention this specification number and its revision letter in all quotations and when acknowledging purchase orders.
2. APPLICATION: Primarily for parts, such as cases and ducts requiring high strength at cryogenic temperatures and for short time use up to 1000 F (538 C), which may require welding during fabrication.
3. COMPOSITION:

|                      | min           | max   |
|----------------------|---------------|-------|
| Carbon               | --            | 0.08  |
| Manganese            | --            | 0.35  |
| Silicon              | --            | 0.35  |
| Phosphorus           | --            | 0.015 |
| Sulfur               | --            | 0.015 |
| Chromium             | 17.00 - 21.00 |       |
| Nickel               | 50.00 - 55.00 |       |
| Cobalt               | --            | 1.00  |
| Molybdenum           | 2.80 - 3.30   |       |
| Columbium + Tantalum | 4.75 - 5.50   |       |
| Titanium             | 0.65 - 1.15   |       |
| Aluminum             | 0.20 - 0.80   |       |
| Boron                | --            | 0.006 |
| Copper               | --            | 0.30  |
| Iron                 | remainder     |       |

- 3.1 Check Analysis: Composition variations shall meet the requirements of the latest issue of AMS 2269.

4. CONDITION: Unless otherwise ordered, the product shall be supplied in the following condition:

- 4.1 Sheet and Strip: Cold rolled, solution heat treated as in 5.1, and descaled unless solution heat treatment is performed in an atmosphere providing a bright finish, having a surface appearance as close as possible to a commercial corrosion resistant steel No. 2D finish.
- 4.2 Plate: Hot rolled, solution heat treated as in 5.1, and descaled unless solution heat treatment is performed in an atmosphere yielding a bright finish.

5. TECHNICAL REQUIREMENTS:

- 5.1 Solution Heat Treatment: Unless otherwise specified, the product shall be solution heat treated to conform to the requirements of 5.2, 5.3, 5.4, and 5.5 and to be capable of meeting the requirements of 5.6. No specific heat treating instructions are specified but it is recommended that the product be solution heat treated by heating in a suitable protective atmosphere to 1950 F  $\pm$  25 (1065.6 C  $\pm$  14) but in no case lower than 1850 F (1010 C), holding at heat for a time commensurate with the thickness, and cooling at a rate equivalent to air cool or faster.

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5.2 Tensile Properties:

|                                                                                                       |             |
|-------------------------------------------------------------------------------------------------------|-------------|
| Tensile Strength, psi                                                                                 | 140,000 max |
| Yield Strength at 0.2% Offset or at 0.0091 in.<br>in 2 in. Extension Under Load (E = 29,600,000), psi | 75,000 max  |
| Elongation, % in 2 in. or 4D                                                                          | 30 min      |

5.2.1 For widths 9 in. and over, tensile test specimens shall be taken with the axis perpendicular to the direction of rolling. For widths less than 9 in., tensile test specimens shall be taken with the axis parallel to the direction of rolling.

5.3 Hardness: Should be not higher than Rockwell C 25 or equivalent but the product shall not be rejected on the basis of hardness if the tensile property requirements are met.

5.4 Bending: Material shall withstand, without cracking, bending at room temperature through an angle of 180 deg around a diameter equal to the bend factor times the nominal thickness of the material, with axis of bend parallel to the direction of rolling.

| Nominal Thickness<br>Inch | Bend Factor |
|---------------------------|-------------|
| Up to 0.050, incl         | 1           |
| Over 0.050 to 0.187, incl | 2           |

5.5 Grain Size: Shall be predominantly 3 or finer with occasional grains as large as 2 permissible, as determined by comparison of a polished and etched specimen with the chart in the issue of ASTM E112 listed in the latest issue of AMS 2350.

5.6 Properties After Precipitation Heat Treatment: The product shall conform to the following requirements after being precipitation heat treated by heating to  $1400\text{ F} \pm 15$  ( $760\text{ C} \pm 8.3$ ), holding at heat for 10 hr, furnace cooling to  $1200\text{ F} \pm 15$  ( $648.9\text{ C} \pm 8.3$ ), holding at  $1200\text{ F} \pm 15$  ( $648.9\text{ C} \pm 8.3$ ) until a total precipitation heat treatment time of 20 hr has been reached, and cooling. The product shall also be capable of meeting the following requirements after being re-solution heat treated by heating to  $1950\text{ F} \pm 25$  ( $1065.6\text{ C} \pm 14$ ) in a suitable protective atmosphere, holding at heat for 1 hr, and cooling at a rate equivalent to air cool or faster and then being precipitation heat treated as above.

5.6.1 Tensile Properties:

|                                                                                                       |             |
|-------------------------------------------------------------------------------------------------------|-------------|
| Tensile Strength, psi                                                                                 | 180,000 min |
| Yield Strength at 0.2% Offset or at 0.0141 in.<br>in 2 in. Extension Under Load (E = 29,600,000), psi | 150,000 min |
| Elongation, % in 2 in. or 4D                                                                          | 15 min      |

5.6.1.1 For widths 9 in. and over, tensile test specimens shall be taken with the axis perpendicular to the direction of rolling. For widths less than 9 in., tensile test specimens shall be taken with the axis parallel to the direction of rolling.

5.6.2 Hardness: Should be not lower than Rockwell C 38 or equivalent, but the product shall not be rejected on the basis of hardness if the tensile property requirements are met.

6. QUALITY: Material shall be produced by multiple melting using consumable electrode practice in the re-melt cycle or shall be induction melted under vacuum, unless otherwise permitted. If consumable electrode remelting is not performed in vacuum, electrodes which have been produced by vacuum induction melting shall be used. The product shall be uniform in quality and condition, clean, sound, and free from foreign materials and from internal and external imperfections detrimental to fabrication or to performance of parts.

7. TOLERANCES: Unless otherwise specified, tolerances shall conform to all applicable requirements of the latest issue of AMS 2262.