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AEROSPACE MATERIAL SPECIFICATION

AMS 5509

Issued 1-15-60
Revised 7- 1-81

ALLOY SHEET AND STRIP, CORROSION AND HEAT RESISTANT 15Cr - 45Ni - 4W - 4Mo - 3Ti - 1Al Consumable Electrode Vacuum Melted

This specification has been declared "NONCURRENT" by the Aerospace Materials Division, SAE, as of 10-13-80. It is recommended that this specification not be specified for new designs.

This cover sheet should be attached to the initial issue of the subject specification.

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AERONAUTICAL MATERIAL SPECIFICATIONS

SOCIETY OF AUTOMOTIVE ENGINEERS, Inc. 485 Lexington Ave., New York 17, N.Y.

AMS 5509

Issued 1-15-60
Revised

ALLOY SHEET AND STRIP, CORROSION AND HEAT RESISTANT 15Cr - 45Ni - 4W - 4Mo - 3Ti - 1Al Consumable Electrode Vacuum Melted

1. ACKNOWLEDGMENT: A vendor shall mention this specification number in all quotations and when acknowledging purchase orders.

2. FORM: Sheet, strip, and plate.

3. APPLICATION: Primarily for parts and assemblies, such as welded turbine nozzle assemblies, burner liner parts, tail pipes, exhaust cone assemblies, and hollow turbine blades, requiring high strength up to 1600 F and oxidation resistance up to 1800 F.

4. COMPOSITION:

		Check Analysis Under Min or Over Max	
Carbon	0.08 max	--	0.01
Manganese	0.75 max	--	0.03
Silicon	0.75 max	--	0.05
Phosphorus	0.040 max	--	0.005
Sulfur	0.040 max	--	0.005
Chromium	14.00 - 16.00	0.25	0.25
Nickel	42.00 - 48.00	0.35	0.35
Molybdenum	3.00 - 4.50	0.10	0.10
Tungsten	3.00 - 4.50	0.15	0.15
Titanium	2.70 - 3.30	0.07	0.07
Aluminum	0.75 - 1.30	0.10	0.10
Boron	0.0080 - 0.016	0.0004	0.001
Iron	remainder		

5. CONDITION: Unless otherwise specified, material shall be solution heat treated and descaled, having a surface appearance as close as possible to a commercial corrosion resistant steel No. 2D finish; standards for acceptance and rejection shall be as agreed upon by purchaser and vendor.

6. TECHNICAL REQUIREMENTS:

6.1 Heat Treatment: Material shall be solution heat treated by heating to 1900 F ± 25, holding at least for a time based on 60 min. per inch of thickness, but not less than 3 min., and quenching in water.

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6.2 Tensile Properties:

Yield Strength at 0.2% Offset or at 0.0107 in. in 2 in. Extension Under Load (E = 30,000,000), psi	100,000 max
Elongation, % in 2 in.	
Nominal Thickness, in.	
Under 0.032	20 min
0.032 and over	25 min

6.2.1 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.

6.3 Hardness: Shall be not higher than Rockwell C 25 or equivalent.

6.4 Bending: Material shall withstand, without cracking, bending at room temperature through an angle of 135 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 Inch	Type of Bend	Bend Factor
Under 0.050	V-Block	1
0.050 to 0.187, incl	V-Block	2

6.5 Properties After Precipitation Heat Treatment:

6.5.1 Material shall conform to the following requirements after heating to 1550 F ± 25, holding at heat for 6 hr, and cooling in air, and then heating to 1300 F ± 25, holding at heat for 16 hr, and cooling in air.

6.5.1.1 Tensile Properties:

Tensile Strength, psi	175,000 min
Yield Strength at 0.2% Offset or at 0.0123 in. in 2 in. Extension Under Load (E = 30,000,000), psi	125,000 min
Elongation, % in 2 in.	
Nominal Thickness, in.	
Under 0.032	5 min
0.032 and over	8 min

6.5.1.1.1 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.

6.5.1.2 Hardness: Not lower than Rockwell C 35 or equivalent.

6.5.1.3 Grain Size: Sheet and strip shall have grain size of 4 or finer as determined by comparison of polished and etched specimens with the chart in ASTM E112-58T. Material predominantly 4 or finer with grains as large as 3 is permissible.

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6.5.2 Material shall be capable of meeting the following requirements after heating to 1550 F ± 25, holding at heat for 6 hr, and cooling in air, and then heating to 1300 F ± 25, holding at heat for 16 hr, and cooling in air.

6.5.2.1 Stress-Rupture Test at 1200 F: A tensile test specimen, maintained at 1200 F ± 3 while an axial stress of 87,500 psi is applied continuously, shall not rupture in less than 15 hr for material under 0.032 in. thick or less than 23 hr for material 0.032 in. and over in thickness.

7. QUALITY: Material shall be multiple melted using consumable electrode practice in the remelt cycle, unless otherwise permitted, and 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.

8. TOLERANCES: Unless otherwise specified, tolerances shall conform to the latest issue of AMS 2242 as applicable and as specified below:

8.1 Thickness: Table I, Table II, and Table III.

8.2 Flatness: Table VI and 7.4.

9. REPORTS:

9.1 Unless otherwise specified, the vendor of the product shall furnish with each shipment three copies of a report of the results of tests for chemical composition of each heat in the shipment and the results of tests on each thickness from each heat to determine conformance to the technical requirements of this specification. This report shall include the purchase order number, heat number, material specification number, thickness, size, and quantity from each heat.

9.2 Unless otherwise specified, the vendor of finished or semi-finished parts shall furnish with each shipment three copies of a report showing the purchase order number, material specification number, contractor or other direct supplier of material, part number, and quantity. When material for making parts is produced or purchased by the parts vendor, that vendor shall inspect each lot of material to determine conformance to the requirements of this specification, and shall include in the report a statement that the material conforms, or shall include copies of laboratory reports showing the results of tests to determine conformance.

10. IDENTIFICATION: Unless otherwise specified, each plate, sheet, and strip shall be marked, in the respective location indicated below, with AMS 5509, heat number, manufacturer's identification, and nominal thickness in inches. The characters shall be not less than 3/8 in. in height, shall be applied using a suitable marking fluid and shall be capable of being removed in hot alkaline cleaning solution without rubbing. The markings shall have no deleterious effect on the material or its performance. The characters shall be sufficiently stable to withstand ordinary handling.

10.1 Plate, Flat Sheet, and Flat Strip Over 6 In. in Width: Shall be marked in lengthwise rows of characters recurring at intervals not greater than 2 ft, the rows being spaced not more than 3 in. apart and alternately staggered.

10.2 Flat Strip 6 in. and Under in Width: Shall be marked near one end.

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