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INTERNATIONAL
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AEROSPACE MATERIAL SPECIFICATION

SAE AMS-QQ-A-250

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Submitted for recognition as an American National Standard

Aluminum and Aluminum Alloy, Plate and Sheet
General Specification for

NOTICE

This document has been taken directly from Federal Specification QQ-A-250F and contains only minor editorial and format changes required to bring it into conformance with the publishing requirements of SAE technical standards.

The original Federal Specification was adopted as an SAE standard under the provisions of the SAE Technical Standards Board (TSB) Rules and Regulations (TSB 001) pertaining to accelerated adoption of government specifications and standards. TSB rules provide for (a) the publication of portions of unrevised government specifications and standards without consensus voting at the SAE Committee level, (b) the use of the existing government specification or standard format, and (c) the exclusion of any qualified product list (QPL) sections.

1. SCOPE AND CLASSIFICATION:

1.1 Scope:

This specification covers the general requirements for aluminum and aluminum alloy plate and sheet. Specific requirements for plate and sheet of a particular alloy are covered by the applicable detail specification (See 6.3).

1.2 Classification:

1.2.1 Tempers: The plate and sheet are classified in tempers as specified in the detail specification. Definitions of tempers are specified in American National Standards ANSI H35.1.

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2. APPLICABLE DOCUMENTS:

The following publications, of the issues in effect on date of invitation for bids or request for proposal, form a part of this specification to the extent specified herein:

2.1 U.S. Government Publications:

Available from DODSSP, Subscription Services Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.

MIL-H-6088	Heat Treatment of Aluminum Alloys
MIL-I-8950	Inspection, Ultrasonic, Wrought Metals, Process for
MIL-STD-649	Aluminum and Magnesium Products, Preparation for Shipment and Storage
FED-STD-123	Marking for Shipment (Civil Agencies)
FED-STD-151	Metals, Test Methods
FED-STD-184	Identification Marking of Aluminum, Magnesium, and Titanium

2.2 ASTM Publications:

Available from ASTM, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.

ASTM B 342	Electrical Conductivity by Use of Eddy Currents
ASTM B 557	Tension Testing Wrought and Cast Aluminum and Magnesium Alloy Products
ASTM B 1193	Reagent Water
ASTM E 290	Semi-Guided Bend Test for Ductility of Metallic Materials
ASTM G 34	Exfoliation Corrosion Susceptibility in 2XXX and 7XXX Series Aluminum Alloys (EXCO Test)
ASTM G 38	Making and Using C-Ring Stress Corrosion Test Specimens
ASTM G 47	Testing Susceptibility to Stress-Corrosion Cracking of High Strength Aluminum Alloy Products
ASTM STP 425	Stress Corrosion Testing (Report of ASTM TG-1 Committee B-3)

2.3 ANSI Publications:

Available from American National Standards Institute, Inc., 11 West 42nd Street, New York, NY 10036-8002.

ANSI H35.1	Alloy and Temper Designation System for Aluminum
ANSI H35.2	Dimensional Tolerances for Aluminum Mill Products

3. REQUIREMENTS:

3.1 Specification Sheets:

The individual item requirements shall be as specified herein and in accordance with the applicable specification sheets.

3.1.1 Chemical Composition: The chemical composition shall be as specified in the detailed specification.

3.2 Mechanical Properties:

Mechanical properties shall be as specified in the detailed specification.

3.3 Permissible Variations:

Unless otherwise specified, the tolerances shall not exceed those specified in ANSI H35.2.

3.4 Marking for Identification:

Plate and sheet shall be marked in accordance with FED-STD-184 and the detailed specification, as required (See 6.3).

3.5 Requirements for Sizes Not Specifically Covered:

Mechanical properties for thicknesses not covered by the detailed specification and tolerances for sizes and thicknesses not covered in ANSI H35.2 shall be as specified in the contract or purchase order (See 6.2).

3.6 Electrical Conductivity:

When specified in the detailed specification, requirements for electrical conductivity shall be as specified when tested in accordance with 4.7.

3.7 Exfoliation Corrosion:

When specified in the detailed specification, plate and sheet processed to meet the applicable mechanical property and electrical conductivity requirements, shall show a level of exfoliation corrosion less than that illustrated in photograph B, Figure 2 of ASTM G34 when tested as specified in 4.8, unless otherwise specified in the detailed specification or purchase order. The supplier shall maintain records of all lots so tested.

3.8 Stress-Corrosion Cracking:

When specified in the detailed specification, plate 0.750 inches or more in thickness, processed to meet the applicable mechanical property and electrical conductivity requirements specified in the detailed specification, shall show no evidence of stress corrosion cracking when tested in accordance with 4.9. This test shall be performed at the stress level specified in the detailed specification. The supplier shall maintain records of the performance of all lots so tested.

3.9 Heat Treatment:

Unless otherwise specified in the detailed specification, contract, or purchase order, heat-treatment for the applicable tempers designated in the detailed specification shall be in accordance with the applicable requirements of MIL-H-6088.

3.10 Internal Defects:

When specified in the detailed specification, plate shall be inspected ultrasonically for internal defects (See 4.3.2).

3.11 Cladding and Cladding Thickness:

Cladding and cladding thickness shall be as specified in the detailed specification (See 4.6).

3.12 Workmanship:

The plate and sheet shall be uniform in quality and condition; clean, sound, smooth, commercially flat, and free from buckles, blisters, and other injurious defects within the limits consistent with the best commercial practice. Discoloration due to thermal treatment shall not be cause for rejection.

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection:

Unless otherwise specified in the contract or purchase order, the contractor is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract or purchase order, the contractor may use his own or any other facilities suitable for the performance of the inspection requirements specified herein. Purchaser reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to ensure that supplies and services conform to prescribed requirements.

4.2 Sampling:

4.2.1 Inspection Lot: An inspection lot shall be as follows:

4.2.1.1 Heat-Treated Lot: For heat-treated tempers, an inspection lot shall consist of an identifiable quantity of material of the same mill form, alloy, temper, and thickness traceable to a heat-treated lot or lots, and subjected to inspection at one time.

4.2.1.2 Non-Heat-Treated Lot: For non-heat-treated tempers, an inspection lot shall consist of an identifiable quantity of material of the same mill form, alloy, temper and thickness subjected to inspection at one time.

4.2.2 Sampling for Chemical Analysis:

4.2.2.1 Ingot Analysis: At least one sample shall be taken from each group of ingots of the same alloy poured simultaneously from the same source of molten metal by the producer and analyzed to determine conformance to 3.1. Ingots not conforming to the requirements of this specification shall be rejected. Complete ingot analysis records shall be available at the producer's plant to the procuring activity.

4.2.2.2 Finish Product Analysis: When compliance with 4.2.2.1 cannot be established, samples shall be selected as follows: One sample shall be taken for each 2000 pounds or less of sheet and for each 4,000 pounds or less of plate comprising a lot, except that not more than one sample shall be taken from the same plate or sheet, when more than one piece is available.

4.2.3 Sampling for Mechanical Tests:

4.2.3.1 Sampling of Coiled Sheet and Flat Sheet: One sample shall be taken from each end of each parent coil (See 6.4), but no more than one sample per 2000 pounds, or part thereof, in a lot shall be required.

4.2.3.2 Sampling of Plate: One sample shall be taken from each end of each parent plate (See 6.4), but no more than one sample per 4000 pounds, or part thereof, in a lot shall be required.

4.2.4 Sampling for Visual and Dimensional Examination: Each plate and sheet shall be examined to determine conformance to this specification with respect to workmanship and identification marking. Examinations for dimensions shall be made to ensure conformance to the tolerances specified. On approval of the procuring activity, the supplier may use a system of statistical quality control for dimensional, marking, and workmanship examination.

4.2.5 Sampling for Electrical Conductivity Tests: Sampling shall be in accordance with 4.2.3.

4.2.6 Sampling for Exfoliation Corrosion and Stress Corrosion Tests: When thickness permits (See 3.8), two samples shall be taken for each 4,000 pounds or less of the first three production lots of each of the applicable tempers for each size range listed in the table of minimum mechanical properties in the detailed specification. Thereafter, surveillance testing shall be performed on at least one sample per month of the applicable tempers for each size range listed in the table of minimum mechanical properties of the detailed specification produced during the month, unless otherwise specified in the detailed specification or purchase order.

4.3 Examination:

4.3.1 Visual and Dimensional Examination: Each sample plate or sheet, selected in accordance with 4.2.4, shall be visually examined and measured to verify conformance with this specification.

4.3.2 Ultrasonic Inspection: When specified in the detailed specification, plate shall be inspected for internal defects in accordance with MIL-I-8950. Acceptance standards shall be as specified in the detailed specification.

4.4 Test Procedures:

4.4.1 Chemical Analysis: Chemical analysis shall be made by the wet chemical method in accordance with Method 111 of FED-STD-151 or by the spectrochemical method in accordance with Method 112 of FED-STD-151. In case of dispute, the chemical analysis by the wet chemical Method 111 shall be the basis for acceptance.

4.4.2 Mechanical Testing:

4.4.2.1 Types of Test Specimens: Tension specimens shall conform to ASTM B 557. For material under 1/2 inch in thickness, a standard rectangular tension specimen with 2-inch gage length shall be used. For material 1/2 to 3/4 inch in thickness and for tension specimens taken in the short-transverse direction, a standard 0.500 inch diameter round tension specimen, or small size round specimen proportional to the standard 0.500 inch diameter round tension specimen having a nominal diameter of 0.350 inch or 0.250 inch, shall be used. For material 3/4 inch and greater in thickness, a standard 0.500 inch diameter round tension specimen shall be used. Sheet less than 3/4 inch in width shall be tested in full section.

4.4.2.2 Locations of Test Specimens: Tension specimens shall be taken from the plate or sheet parallel to or perpendicular to the direction of final rolling as specified in the detailed specification. From plate, in thicknesses 0.5 to 1.5 inches inclusive, tension specimens shall be taken with the axis midway between the two plate surfaces; from plate in thicknesses greater than 1.5 inches, the axis of the tension specimen shall be three-fourths of the distance from one surface to the other.

4.4.2.2.1 Tensile Strength: Tensile strength shall be determined in accordance with ASTM B 557.

4.4.2.2.2 Yield Strength: The yield strength shall be determined in accordance with ASTM B 557.

4.5 Bend Test:

When specified in the detailed specification, specimens tested in accordance with ASTM E 290 shall be capable of being bent either parallel with, or transverse to the direction of final rolling, at room temperature through 180 degrees around a mandrel having a diameter equal to N times the nominal thickness of the sheet or plate. If material is too narrow to bend parallel to the direction of rolling, bending should be done transverse to the direction of rolling. Specimens shall be bent by either pressure or blows. The values for N shall be as specified in the detailed specification. For material alclad one side, the bare surface shall be on the outside of the bend.

4.6 Cladding Thickness of Alclad Sheet and Plate:

When specified in the detailed specification, if a question arises concerning the uniformity of cladding of the finished sheet or plate, not fewer than three transverse samples approximately 3/4 inch in length, shall be mounted to expose an edge perpendicular to the plane of the sample and polished for microscopic examination. After etching with Keller's etch or other suitable etch to differentiate between core and cladding, each specimen shall be examined at a minimum magnification of 100 diameters and the maximum and minimum cladding thickness shall be measured in each of 5 fields approximately 1/10 inch apart along each alclad side of the exposed edge of each mounted specimen. The average of the 10 thickness measurements on each alclad side of the exposed edge of each mounted specimen is the average cladding thickness, and shall not be less than the minimum average specified.

4.7 Electrical Conductivity:

When specified in the detailed specification, electrical conductivity shall be determined in accordance with ASTM B 342. The measurements shall be performed on the same sample used for tensile testing. For clad material, the cladding must be removed before making the conductivity measurements.

4.8 Resistance to Exfoliation Corrosion:

Specimens shall be prepared and tested in accordance with ASTM G 34 unless otherwise specified in the detailed specification or purchase order. For all materials 0.100 inch or more in thickness, 10 percent of the thickness shall be removed by machining one surface. The machined surface shall be evaluated after testing. For alclad material, cladding on the side opposite the test surface must be either removed or masked. Chemical milling may be used in lieu of machining.

4.9 Resistance to Stress-Corrosion Cracking:

Specimens shall be prepared and tested in accordance with ASTM G 47 or as otherwise specified in the detailed specification or purchase order.

4.10 Rejection and Retest:

If any specimen fails to conform to requirements of this specification, it shall be cause for rejection of the material represented by the specimen subject to the retest provisions of FED-STD-151. When no sampling plan is provided, or approved by the procuring agency, and when there is evidence that indicates that a failed specimen was not representative of the lot of material, and when the detailed specification does not specify otherwise, at least two specimens shall be selected to replace each test specimen which failed. All specimens so selected for retest shall meet the requirements of the specification or the lot shall be subject to rejection.

5. PREPARATION FOR DELIVERY:

5.1 Preservation, Packaging and Packing:

All sheet and plate shall be preserved, packaged, and packed in accordance with the requirements of MIL-STD-649. Unless otherwise specified (See 6.2), sheet and plate shall be preserved, packaged, and packed in accordance with Level C.

5.2 Marking:

5.2.1 Civil Agencies: Marking for shipment shall be in accordance with FED-STD-123. In addition, any special contract or purchase order marking requirements shall be adhered to.

5.2.2 Military Agencies: Marking for shipment shall be in accordance with MIL-STD-649. In addition, any special contract or purchase order marking requirements shall be adhered to.

6. NOTES:

6.1 Intended Use:

See detailed specification.

6.2 Ordering Data:

See detailed specification.