

FEDERAL SPECIFICATION

ALUMINUM AND ALUMINUM ALLOY PLATE AND SHEET: GENERAL SPECIFICATION FOR

This specification was approved by the commissioner, Federal Supply Service, General Services Administration, for the use of all Federal agencies.

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 detailed specification (see 6.3).

1.2 Classification.

1.2.1 Tempers. The plate and sheet shall be classified in tempers as specified in the detailed specification. The definitions of these tempers shall be as specified in American National Standards ANSI H35.1.

2. APPLICABLE DOCUMENTS

2.1 Government publications. The following documents of the issue in effect on date of invitation for bids or request for proposal, form a part of this specification to the extent specified herein.

Federal Standards:

Fed. Std. No. 123 - Marking for Shipment (Civil Agencies).

Fed. Test Method Std. No. 151 - Metals; Test Methods.

Fed. Std. No. 184 - Identification Marking of Aluminum, Magnesium and Titanium.

(Activities outside the Federal Government may obtain copies of Federal Specifications and Standards, as outlined under General Information in the Index of Federal Specifications and Standards and at the prices indicated in the Index. The Index, which includes cumulative monthly supplements as issued, is for sale on a subscription basis by the Superintendent of Documents, US Government Printing Office, Washington, DC 20402.

(Single copies of this specification and other Federal Specifications required by activities outside the Federal Government for bidding purposes are available without charge from Business Service Centers at the General Services Administration Regional Offices in Boston, New York, Washington, DC, Philadelphia, Atlanta, Chicago, Kansas City, MO, Fort Worth, Houston, Denver, San Francisco, Los Angeles and Seattle, WA.

(Federal Government activities may obtain copies of Federal Specifications, Standards and Handbooks and the Index of Federal Specifications and Standards from established distribution points in their agencies.)

Military Specifications:

MIL-H-6088 - Heat Treatment of Aluminum Alloys.

MIL-I-8950 - Inspection, Ultrasonic, Wrought Metals; Process for.

Military Standard:

MIL-STD-649 - Aluminum And Magnesium Products; Preparation For Shipment And Storage.

(Copies of Military Specifications and Standards required by contractors in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

2.2 Other publications. The following documents form a part of this specification to the extent specified herein. Unless a specific issue is identified the issue in effect on date of invitation for bids or request for proposal shall apply.

American National Standards Institute (ANSI) Standards:

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

(Application for copies should be addressed to the American National Standards Institute, 1430 Broadway, New York, NY-10018.)

American Society for Testing and Materials (ASTM) Standards:

ASTM B342 - Electrical Conductivity by Use of Eddy Currents.
ASTM B557 - Tension Testing Wrought and Cast Aluminum and Magnesium Alloy Products.
ASTM E290 - Semi-Guided Bend Test for Ductility of Metallic Materials.
ASTM G34 - Exfoliation Corrosion Susceptibility in 7XXX Series Copper Containing Aluminum Alloys (EXCO Test).

ASTM G47 - Standard Recommended Practice for Testing Susceptibility to Stress Corrosion Cracking of High Strength 7XXX Series Aluminum Alloy Products.

(Application for copies should be addressed to the American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103:)

Uniform Classification Committee, Agent:

Uniform Freight Classification.

(Application for copies should be addressed to the Uniform Classification Committee, Room 202 Union Station, 516 W. Jackson Blvd., Chicago, Illinois 60606.)

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. No. 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 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 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 order, the contractor may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government.

4.2 Sampling.

4.2.1 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 lb., 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 lb., 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 insure 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 product 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. Test Method Std. No. 151 or by the spectrochemical method in accordance with method 112 of Fed. Test Method Std. No. 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 test specimens shall conform to ASTM E557. For material less than 1/2 inch in thickness, a standard rectangular tension test specimen with 2 inch gage length shall be used. For material 1/2 to 3/4 inch in thickness and for tension test specimens taken in the short transverse direction, a standard 0.500 inch diameter round tension test specimen, or small size round specimen proportional to the standard 0.500 inch diameter round tension test 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 test 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 test 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 test 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 test 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 E557.

4.4.2.2.2 Yield strength. The yield strength shall be determined in accordance with ASTM E557.

4.5 Bend test. When specified in the detailed specification, specimens tested in accordance with ASTM E290 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 R 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 B342. 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 G34 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 G47 or as otherwise specified in the detailed specification or purchase order.

4.10 Rejection and retest. If any specimen fails to conform to the requirements of this specification, it shall be cause for rejection of the material represented by the specimen subject to the retest provisions of Fed. Test Method Std. No. 151. When no sampling plan is provided, or

- QQ-A-250/13 - Aluminum Alloy Alclad 7075, Plate and Sheet.
(QQ-A-287.)
- QQ-A-250/14 - Aluminum Alloy 7178, Plate and Sheet. (MIL-A-9180.)
- QQ-A-250/15 - Aluminum Alloy Alclad 7178, Plate and Sheet.
(MIL-A-9183.)
- QQ-A-250/18 - Aluminum Alloy Alclad One Side 7075, Plate and Sheet.
(MIL-A-8902.)
- QQ-A-250/19 - Aluminum Alloy 5086, Plate and Sheet for Seawater
Applications.
- QQ-A-250/20 - Aluminum Alloy 5456, Plate and Sheet for Seawater
Applications.
- QQ-A-250/21 - Aluminum Alloy, 7178-T76, Plate and Sheet, (Exfoliation
Resistant).
- QQ-A-250/22 - Aluminum Alloy, 7178-T76, Plate and Sheet, Alclad (Exfoliation
Resistant).
- QQ-A-250/24 - Aluminum Alloy, 7075, Plate and Sheet, (Exfoliation
Resistant).
- QQ-A-250/25 - Aluminum Alloy Alclad 7075, Plate and Sheet, (Exfoliation
Resistant).
- QQ-A-250/26 - Aluminum Alloy 7075, Alclad 7011, Plate and Sheet.
- QQ-A-250/28 - Aluminum Alloy 7178, Alclad 7011, Plate and Sheet.
- QQ-A-250/29 - Aluminum Alloy 2124, Plate.
- QQ-A-250/30 - Aluminum Alloy 2219, Plate and Sheet.

6.4 Definitions.

6.4.1 Capable of. The term "capable of" as used in the detailed specification means that the test need not be performed by the producer of the plate and sheet. However, should subsequent testing by the procuring activity establish that the material does not meet these requirements, the plate and sheet are subject to rejection.

6.4.2 Sheet. A rolled rectangular section of thickness 0.006 through 0.249 inch, with sheared, slit, or sawed edges.

6.4.3 Alclad sheet. A composite sheet having on both surfaces (if one side only, alclad one side sheet) a metallurgically bonded aluminum or aluminum alloy coating which is anodic to the core, thus electrolytically protecting the core against corrosion.

6.4.4 Plate. A rolled rectangular section of thickness 0.250 inch or more, with either sheared or sawed edges.

6.4.5 Parent coil. A coil of sheet which has been processed to the final temper as a single unit and subsequently cut into two or more smaller coils or into individual sheets to provide the required width and length.

6.4.6 Parent plate. A plate which has been processed to final temper as a single unit and subsequently cut into two or more smaller plates to provide the required width and/or length.

6.5 It is standard practice in the United States aluminum industry to determine conformance to the chemical composition limits prior to further processing of ingots into wrought products. Due to the continuous nature of the process, it is not practical to keep a specific ingot analysis identified with a specific quantity of finished material.

6.6 Certain provisions of this specification are the subject of international standardization agreement ABC-NAVY-STD-44. When amendment, revision or cancellation of this specification is proposed which will effect or violate the international agreement concerned, the preparing activity will take appropriate reconciliation action through international standardization channels including departmental standardization officer, if required.

MILITARY CUSTODIANS:

Army - MR
 Navy - AS
 Air Force - 11

Preparing activity:

Navy - AS

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Review activities:

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