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AEROSPACE MATERIAL SPECIFICATION

SAE AMS-QQ-A-250/25

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Submitted for recognition as an American National Standard

ALUMINUM ALLOY, ALCLAD 7075 PLATE AND SHEET IMPROVED EXFOLIATION RESISTANT

UNS A87075

NOTICE

This document has been taken directly from Federal Specification QQ-A-250/25A 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.

The complete requirements for procuring 7075 aluminum alloy alclad plate and sheet for improved exfoliation resistance described herein shall consist of this document and the latest issue of AMS-QQ-A-250.

1. SCOPE AND CLASSIFICATION:

1.1 Scope:

This specification covers the specific requirement for improved exfoliation-resistant 7075 aluminum alloy alclad plate and sheet. The general requirements are covered in AMS-QQ-A-250. The plate and sheet covered by this specification shall be an integral composite product consisting of a heat-treated aluminum alloy (7075) core with thin layers of an aluminum alloy (7072) anodic to the core and of approximately equal thickness, bonded to both surfaces.

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1.2 Classification:

Sheet shall be furnished only in the T76 temper and plate shall be furnished only in the T7651 temper, as specified (See 6.2). Definitions of these tempers are in accordance with AMS-QQ-A-250 and as follows:

T76 - Solution heat-treated and artificially aged sufficient to produce improved resistance to exfoliation and stress-corrosion cracking.

T7651 - Solution heat-treated, stress relieved by stretching to produce a nominal permanent set of 2 percent but not less than 1-1/2 percent nor more than 3 percent, and artificially aged sufficient to produce improved resistance to exfoliation and stress-corrosion cracking. Plate shall receive no further straightening after stretching.

2. APPLICABLE DOCUMENTS:

See AMS-QQ-A-250.

3. REQUIREMENTS:

3.1 Chemical Composition:

The chemical composition of the core ingots or slabs and of the cladding plates used for the manufacture of the clad plates and sheets shall conform to the requirements shown in Table I for core and cladding, respectively.

TABLE I. Chemical Composition 1/

Element	Composition			
	Core Alloy (7075) Percent		Cladding Alloy (7072) Percent	
	Minimum	Maximum	Minimum	Maximum
Zinc	5.1	6.1	0.8	1.3
Magnesium	2.1	2.9	--	0.10
Copper	1.2	2.0	--	0.10
Chromium	0.18	0.35	--	--
Manganese	--	0.30	--	0.10
Iron	--	0.50	--	2/
Silicon	--	0.40	--	2/
Titanium	--	3/	--	--
Zirconium	--	3/	--	--
Other Elements, each	--	0.05	--	0.05
Other Elements, total	--	0.15	--	0.15
Aluminum	Remainder		Remainder	

1/ Analysis shall routinely be made only for the elements specifically mentioned in Table I. If, however, the presence of other elements is indicated or suspected in amounts greater than the specified limits, further analysis shall be made to determine that these elements are not present in excess of specified limits.
2/ Iron plus silicon, 0.7 percent maximum.
3/ Titanium plus zirconium, 0.25 percent maximum.

3.2 Mechanical Properties:

Mechanical properties perpendicular to the direction of final rolling, except for material under 9 inches in width, shall conform to the requirements of Table II for the temper specified. For material under 9 inches in width, the mechanical properties parallel to the direction of final rolling shall conform to the requirements of Table II for the temper specified.

TABLE II. Mechanical Properties

Temper	Thickness Inches	Tensile Strength ksi minimum	Yield Strength at 0.2 percent Offset ksi, minimum	Elongation in 2 in. or 4 times D 1/ 2/, minimum
T76	0.040 thru 0.062	67.0	56.0	8
	0.063 thru 0.187	68.0	57.0	8
	0.188 thru 0.249	70.0	59.0	8
T7651	0.250 thru 0.499	69.0	58.0	8
	0.500 thru 1.000	71.0 3/	60.0 3/	6

1/ Not required for material 1/2 inch and under in width.
2/ D represents specimen diameter.
3/ The properties for these thicknesses are those of the core alloy since the test is made on a round specimen machined from the plate.

3.3 Cladding Thickness:

3.3.1 Thickness of Cladding Plates: The aluminum alloy (7072) plates that are bonded to the two sides of the aluminum alloy (7075) ingot or slab to form a composite that is to be rolled to the finished thickness shall each have a thickness as specified in Table III.

3.3.2 Average Thickness of Cladding: When specified (See 6.2), the average cladding thickness of the finished sheet or plate shall be determined. Samples, examined in accordance with AMS-QQ-A-250, shall show an average of cladding on each side as specified in Table III.

TABLE III. Cladding Thickness

Thickness of Finished Sheet or Plate Inches	Nominal Cladding Thickness per Side; percent of composite thickness	Average Minimum Cladding Thickness per Side on Finished Sheet or Plate; percent of sheet or plate thickness
Up thru 0.062	4	3.2
0.063 thru 0.187	2.5	2
0.188 and over	1.5	1.2 1/

1/ For plate 0.500 inch and over, the average cladding thickness per side shall have a maximum value of 3 percent of the plate thickness.

3.4 Exfoliation and Stress-Corrosion Cracking:

Material in the T76 and T7651 tempers, when tested in accordance with 4.2.1 and 4.2.2, shall show neither exfoliation corrosion equivalent to or in excess of that depicted in Figure 2 of ASTM G 34-72 for category B nor stress-corrosion cracking susceptibility beyond the acceptance criteria detailed in 4.2.2.5.

3.4.1 Lot Acceptance Control Criteria for T76 and T7651 Tempers: Resistance to exfoliation and stress-corrosion cracking for each inspection lot of T76 and T7651 temper material shall be determined by the following control criteria (See 4.1.2 and 4.2.2).

3.4.1.1 Determine mechanical properties and electrical conductivity.

3.4.1.2 If the conductivity is 38 percent IACS or higher, and the tensile properties meet the minimum limits specified herein, the material is acceptable.

3.4.1.3 If the conductivity is at least 36 percent IACS but less than 38 percent IACS, the material shall be tested as specified in 4.2.1 or reprocessed.

3.4.1.4 If the conductivity is below 36 percent IACS, the material is not acceptable and must be reprocessed.

3.5 Internal Defects:

When specified (See 6.2), plate shall be ultrasonically inspected (See AMS-QQ-A-250). Acceptance limits shall be as specified in Table IV.

TABLE IV. Ultrasonic Discontinuity Acceptance Limits 1/

Size		Discontinuity Class 2/
Thickness Inches	Maximum Weight per Piece Pounds	
0.500 thru 1.000	2,000	B

1/ Discontinuities in excess of those listed in Table IV may be allowed, subject to approval of the procuring activity, if it is established that they will be removed by machining or that they are in non-critical areas.
2/ The discontinuity class limits are defined in MIL-I-8950.

3.6 Marking:

In addition to the marking required in FED-STD-184, plate and sheet shall be identified by an inspection lot number marked in at least one location on each piece.

4. QUALITY ASSURANCE PROVISIONS:

See AMS-QQ-A-250 and the following:

4.1 Sampling:

4.1.1 For Exfoliation and Stress-Corrosion Cracking Tests: Two samples shall be taken for each 4,000 pounds or less of the first three production lots for each size range of sheet and plate listed in Table II. Thereafter, surveillance testing shall be performed on at least one sample per month for each size range of sheet and plate produced during that month which had previously been produced with acceptable exfoliation resistance. The surveillance test samples shall be taken from an inspection lot which has met the requirements of 3.4.1.1. Samples as above shall be taken for stress-corrosion cracking test when thickness permits (See 4.2.2).

4.1.2 For Mechanical Property and Conductivity Tests: Sampling shall be in accordance with AMS-QQ-A-250 for mechanical property tests. Mechanical properties and conductivities shall be determined on the same samples except cladding must be removed before testing for conductivity (See 4.2.3). Conductivity shall be determined prior to testing for mechanical properties.

4.2 Tests:

4.2.1 Exfoliation Corrosion Test: Test shall be performed in accordance with ASTM G 34. Full thickness specimens of sheet and plate large enough to provide visual assessment of attack may be used, however, 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.

4.2.2 Stress-Corrosion Cracking Test: Stress-corrosion cracking tests shall be performed on plate 0.750 inch and over in thickness as follows.

4.2.2.1 Specimens: Specimens shall be selected in a manner such as to permit application of the specific tension stress in the short-transverse direction. Specimens shall be C-rings as detailed in FED-STD-151, Method 823, or in ASTM G 38.

4.2.2.2 Exposure Period: Exposure shall be for 30 days.

4.2.2.3 Tension Stress: The tensile stress applied in the short-transverse direction (perpendicular to grain flow) shall be 25.0 ksi, and the specimen shall be held at constant strain.

4.2.2.4 Exposure Procedure: The stressed specimen shall be exposed to a 3.5 percent salt solution prepared by dissolving reagent grade sodium chloride (NaCl) in distilled or deionized ASTM D 1193, Type II, water. The pH of the solution shall be 6.4 to 7.2. The solution temperature shall be 75 °F ± 2, air temperature shall be 80 °F ± 2, and with a relative humidity of 45 percent ± 6. The alternate immersion cycle shall consist of 10 minutes immersion in solution and 50 minutes in air, with sufficient circulation to dry the specimens slowly before the next immersion.

4.2.2.5 Stress-Corrosion Test Results: After a 30-day exposure, the specimen shall exhibit no visual evidence of stress-corrosion cracking. Any highly directional attack which is suspected of concealing a stress-corrosion crack shall be cross sectioned and examined metallographically. An example of stress-corrosion cracking is shown on Figure 1. Figure 2 illustrates pitting type attack which does not constitute failure.

4.2.3 Electrical Conductivity Tests: The conductivity shall be determined by taking three electrical conductivity readings at random on each sample. For thicknesses under 0.100 inch, the conductivity shall be determined on the surface after removal of the cladding. For thicknesses of 0.100 inch and over, the conductivity shall be determined on the machined surface after machining one surface of the sample to a depth of approximately 10 percent of the product thickness. The surface machining may be accomplished by chemical milling. The average of the three reading shall be used as the conductivity acceptance criteria of 3.5.1.

4.3 Records:

The producer shall maintain records of the performance of all inspection lots sampled and tested. Upon request of the procuring activity, such records shall be made available. These records shall be maintained for not less than one year after completion of the contract or purchase order.

5. PREPARATION FOR DELIVERY:

See AMS-QQ-A-250.

6. NOTES:

6.1 Intended Use:

This alloy is intended for use where high strength is required and where exfoliation and corrosion resistance superior to 7075-T6 is required. 7011 Alclad 7075 plates and sheets should be used where fatigue strength and mechanical properties higher than those provided by 7072 Alclad 7075 are required and where good resistance to corrosion is needed.