AEROSPACE MATERIAL SPECIFICATION

AMS-QQ-A-250/30	REV. A

Issued 1997-08
Reaffirmed 2010-05
Stabilized 2013-12

Superseding AMS-QQ-A-250/30

Aluminum Alloy 2219, Plate and Sheet

A92219

RATIONALE

AMS-QQ-A-250/30A results from a five year review of this specification.

STABILIZATION NOTICE

AMS-QQ-A-250/30A has been declared "STABILIZED" by AMS Committee D. This document will no longer be updated and may no longer represent standard industry practice. The last technical update of this document occurred in August 1997. Users of this document should refer any certification issues (e.g. exceptions listed on the certification report) to the cognizant engineering organization for their disposition. CAUTION: In many cases the purchaser is not the cognizant engineering organization (i.e. purchaser may be a sub tier supplier).

AMS Committee D recommends that the following technically equivalent (e.g. properties, fit, form, function) specifications be used for future procurement. This listing does not constitute authority to substitute these specifications for the "STABILIZED" specification.

AMS4031 Aluminum Alloy, Sheet and Plate 6.3Cu - 0.30Mn - 0.18Zr - 0.10V - 0.06Ti (2219-0) Annealed or when specified, "As Fabricated" (2219-F)

AMS4601 Aluminum Alloy, Sheet and Plate 6.3Cu - 0.30Mn - 0.06Ti - 0.10V - 0.18Zr Solution Heat Treated, Cold Worked and Naturally Aged (2219 -T31/-T351)

AMS4599 Aluminum Alloy, Sheet and Plate 6.3Cu - 0.30Mn - 0.06Ti - 0.10V - 0.18Zr Solution and Precipitation Heat Treated (2219 -T81/-T851)

AMS4600 Aluminum Alloy, Sheet and Plate 6.3Cu - 0.30Mn - 0.06Ti - 0.10V - 0.18Zr Solution Heat Treated, Cold Worked (8%) and Naturally Aged (2219 -T37)

AMS4613 Aluminum Alloy, Sheet and Plate 6.3Cu - 0.30Mn - 0.06Ti - 0.10V - 0.18Zr Solution Heat Treated, Cold Worked (8%) and Precipitation Heat Treated (2219 -T87)

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NOTICE

This document has been taken directly from Federal Specification QQ-A-250/30A, Amendment 1, 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 2219 aluminum alloy plate and sheet described herein shall consist of this document and the latest issue of AMS-QQ-A-250.

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1. SCOPE AND CLASSIFICATION:

1.1 Scope:

This specification covers the specific requirements for 2219 aluminum alloy plate and sheet.

1.2 Classification:

1.2.1 Tempers: The plate and sheet are classified in one of the following tempers as specified (See 6.3 and 6.4): O, T31, T37, T62, T81, T87, T351, T851, or F temper. Definitions of these tempers are specified in AMS-QQ-A-250.

2. APPLICABLE DOCUMENTS:

See AMS-QQ-A-250.

3. REQUIREMENTS:

3.1 Chemical Composition:

3.1.1 The chemical composition shall conform to the requirements specified in Table I.

TABLE I. Chemical Composition 1/

Element	Percent	
	minimum	maximum
Copper	5.8	6.8
Manganese	0.20	0.40
Zirconium	0.10	0.25
Vanadium	0.05	0.15
Titanium	0.02	0.10
Iron	--	0.30
Silicon	--	0.20
Zinc	--	0.10
Magnesium	--	0.02
Other Elements, each	--	0.05
Other Elements, total	--	0.15
Aluminum	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.

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3.2 Mechanical Properties:

3.2.1 Mechanical Properties of Material as Supplied: The 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 (See 6.7)

Temper	Thickness Inches	Tensile Strength minimum ksi	Yield Strength at 0.2 percent Offset minimum ksi	Elongation in 2 inches 1/ or 4 times D 2/ minimum percent
O	0.020 - 2.000	32.0 (max)	16.0 (max)	12
T31	0.020 - 0.039	46.0	29.0	8
	0.040 - 0.249	46.0	28.0	10
T351	0.250 - 2.000	46.0	28.0	10
	2.001 - 3.000	44.0	28.0	10
	3.001 - 4.000	42.0	27.0	9
	4.001 - 5.000	40.0	26.0	9
	5.001 - 6.000	39.0	25.0	8
T37	0.020 - 0.039	49.0	38.0	6
	0.040 - 2.500	49.0	37.0	6
	2.501 - 3.000	47.0	36.0	6
	3.001 - 4.000	45.0	35.0	5
	4.001 - 5.000	43.0	34.0	4
T62 3/	0.020 - 0.039	54.0	36.0	6
	0.040 - 0.249	54.0	36.0	7
	0.250 - 1.000	54.0	36.0	8
	1.001 - 2.000	54.0	36.0	7
T81	0.020 - 0.039	62.0	46.0	6
	0.040 - 0.249	62.0	46.0	7
T851	0.250 - 1.000	62.0	46.0	8
	1.001 - 2.000	62.0	46.0	7
	2.001 - 3.000	62.0	45.0	6
	3.001 - 4.000	60.0	44.0	5
	4.001 - 5.000	59.0	43.0	5
	5.001 - 6.000	57.0	42.0	4

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TABLE II. Mechanical Properties (See 6.7) (Continued)

Temper	Thickness Inches	Tensile Strength minimum ksi	Yield Strength at 0.2 percent Offset minimum ksi	Elongation in 2 inches 1/ or 4 times D 2/ minimum percent
T87	0.020 - 0.039	64.0	52.0	5
	0.040 - 0.249	64.0	52.0	6
	0.250 - 1.000	64.0	51.0	7
	1.001 - 3.000	64.0	51.0	6
	3.001 - 4.000	62.0	50.0	4
	4.001 - 5.000	61.0	49.0	3
F	All	4/	4/	4/

1/ Not required for material 1/2 inch or less in width.
2/ D represents specimen diameter.
3/ Material in the T62 temper is a user heat-treated condition and is not available from the material producer.
4/ No requirements.

3.2.2 Mechanical Properties After Heat Treatment: In addition to conforming to requirements of 3.2.1, material in the tempers identified in the following paragraphs shall, after having been processed to tempers also identified therein, have properties conforming to those specified in Table II, as applicable.

3.2.2.1 Material in the Annealed (O) and As-Fabricated (F) Tempers: Material in the O or F tempers, without the subsequent imposition of cold work or forming operations, shall, after proper solution and artificial aging treatments, develop the properties specified for the T62 temper (See 6.2).

3.2.2.2 Material in the T31, T351, T81, and T851 Tempers: Material in the T31, T351, T81, and T851 tempers shall, without the subsequent imposition of cold work or forming operations, be heat treatable to the properties specified for the T62 temper. Such capability shall be demonstrated when specified (See 6.2 and 6.4).

3.2.2.3 Material in the T31, T351, and T37 Tempers: Material in the T31, T351, and T37 tempers shall be precipitation heat treatable to the properties specified for the T81, T851, and T87 tempers, respectively. Such capability shall be demonstrated when specified (See 6.4).

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3.2.3 Bend Test: Bend specimens taken from material shall be capable of withstanding without cracking the bend test specified in AMS-QQ-A-250. The values for bend factor N are given in Table III.

TABLE III. Bend Test Factor "N".

Thickness, Inch	O temper
0.020 - 0.250	4
0.251 - 0.750	6
0.751 - 1.000	8

3.3 Internal Defects:

When specified (See 6.4), 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/

Thickness, inches	Maximum Weight per Piece, pounds 2/	Discontinuity Class 3/
0.500 - 1.499	2,000	B
1.500 - 3.000	2,000	A
3.001 - 4.500	2,000	B
4.501 - 6.000	4/	4/

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/ Class for weights in excess of those shown shall be as agreed upon between the user and supplier.
3/ The discontinuity class limits are defined in MIL-I-8950.
4/ Shall be as agreed upon by purchaser and supplier.

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3.4 Resistance to Stress-Corrosion Cracking:

Plate 0.750 inch and over in thickness supplied in the T851 and T87 tempers or in the T351 and T37 tempers and aged to the T851 and T87 tempers shall exhibit no stress-corrosion cracking when subjected to the test specified in 4.3. Frequency of testing shall be in accordance with AMS-QQ-A-250. When specified (See 6.4), plate 0.750 inch and thicker, without prior cold work or forming, heat-treated to the T62 temper shall exhibit no stress-corrosion cracking when subjected to the test specified in 4.3 (See 6.2).

3.5 Marking:

In addition to the marking required in AMS-QQ-A-250, sheet and plate in the T81, T87, and T851 tempers 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 Heat Treatment:

4.1.1 Aging Period Before Testing: Specimens in the T31, T351, and T37 tempers shall not be required to be tested within 4 days after completion of the heat treatment. If the manufacturer so elects, samples may be tested after less than 4 days aging; but if they fail to meet specified properties, the test samples may be discarded and additional specimens may be tested after 4 days aging. These specimens shall be taken from the same locations in the production lot or sample from which the prior specimens were taken.

4.2 Mechanical Tests After Heat Treatment:

4.2.1 Number of Tests After Heat Treatment: From material in each temper of those specified for heat treatment capability demonstrations in 3.2.2 and 6.2, an additional number of specimens equal to that required in AMS-QQ-A-250 shall be taken and tested after heat treatment to each temper specified to determine conformance to 3.2.2.

4.3 Stress-Corrosion Cracking Test:

Samples of plate in the thicknesses and tempers identified in 3.4 shall be taken in accordance with AMS-QQ-A-250. Test specimens shall be selected in a manner that will permit application of the specified tensile stress in the short-transverse direction with respect to grain flow. Specimens shall be stressed in tension in the short-transverse direction and be held at constant strain. The stress level shall be 75 percent of the long-transverse yield strength. The specimens shall be subjected to the stress-corrosion test specified in AMS-QQ-A-250.

4.4 Records:

It is the responsibility of the contractor that all test results be recorded, identified as to inspection lot, and preserved after completion of the contract or purchase order. The records shall be made available to the procuring activity upon request.

5. PREPARATION FOR DELIVERY:

See AMS-QQ-A-250.

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