



AEROSPACE MATERIAL SPECIFICATION

AMS-QQ-A-200/8**REV. A**

Issued 1997-07
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Stabilized 2015-05

Superseding AMS-QQ-A-200/8

Aluminum Alloy 6061, Bar, Rod, Shapes,
Tube, and Wire, Extruded
A96061

RATIONALE

AMS-QQ-A200/8A stabilizes this document because equivalent technical requirements are contained in AMS4150, AMS4160, AMS4161, AMS4172, and AMS4173.

STABILIZATION NOTICE

AMS QQ-A-200/8A has been declared "STABILIZED" by AMS Committee D. This document will no longer be updated and may no longer represent standard industry practice. This document was stabilized because it contains requirements that are no longer state of the art and are also contained in alternate documents that contain equivalent requirements. Previously this document was reaffirmed. AMS Committee D has never performed a technical update of this document. Users of this document should refer to the cognizant engineering organization for disposition of any issues with reports/certifications to this specification; including exceptions listed on the certification. NOTE: In many cases, the purchaser may represent a sub tier supplier and not the cognizant engineering organization.

AMS Committee D recommends that the following technically equivalent specifications be used for future procurement. This listing does not constitute authority to substitute these specifications for the "STABILIZED" specification.

AMS4150	Aluminum Alloy, Extrusions and Rings 1.0Mg - 0.60Si - 0.28Cu - 0.20Cr - (6061-T6) Solution and Precipitation Heat Treated
AMS4160	Aluminum Alloy, Extrusions, 1.0Mg - 0.60Si - 0.28Cu - 0.20Cr (6061-O), Annealed
AMS4161	Aluminum Alloy, Extrusions, 1.0Mg - 0.60Si - 0.28Cu - 0.20Cr (6061-T4), Solution Heat Treated and Naturally Aged
AMS4172	Aluminum Alloy, Extrusions, 1.0Mg - 0.60Si - 0.28Cu - 0.20Cr (6061-T4511) Solution Heat Treated and Stress Relieved by Stretching
AMS4173	Aluminum Alloy, Extrusions 1.0Mg - 0.60Si - 0.30Cu - 0.20Cr (6061-T6511) Solution Heat Treated, Stress Relieved by Stretching, Straightened, and Precipitation Heat Treated

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NOTICE

This document has been taken directly from Federal Specification QQ-A-200/8F 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 aluminum alloy 6061 bar, rod, shapes, tube, and wire extruded described herein shall consist of this document and the latest issue of AMS-QQ-A-200.

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1. SCOPE AND CLASSIFICATION:

1.1 Scope:

This specification covers the specific requirements for aluminum alloy 6061 bar, rod, shapes, tube, and wire produced by extrusion.

1.2 Classification:

1.2.1 Tempers: Bar, rod, shapes, tube, and wire are classified in the following tempers as specified (See 6.2): O, T1, T4, T42, T4510, T4511, T51, T6, T62, T6510, or T6511. Definitions of tempers are specified in AMS-QQ-A-200.

1.2.2 Tubing: Tubing shall be additionally classified as follows:

<u>Type</u>	<u>Description</u>
I	- Tubing extruded from hollow billets using die and mandrel (See AMS-QQ-A-200).
II	- Tubing extruded from solid billets using a porthole or spider die or similar tooling (See AMS-QQ-A-200).

2. APPLICABLE DOCUMENTS:

See AMS-QQ-A-200.

3. REQUIREMENTS:

3.1 Chemical Composition:

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

TABLE I. Chemical Composition 1/

Element	Percent	
	Minimum	Maximum
Magnesium	0.8	1.2
Silicon	0.40	0.8
Copper	0.15	0.40
Iron	--	0.7
Chromium	0.04	0.35
Zinc	--	0.25
Titanium	--	0.15
Manganese	--	0.15
Other Elements, each	--	0.05
Other Elements, total <u>2/</u>		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 the limits specified.

2/ The sum of those "Others" metallic elements 0.010 percent or more each, expressed to the second decimal before determining the sum.

3.2 Mechanical Properties:

- 3.2.1 Mechanical Properties of Material as Supplied: The mechanical properties in the direction of extrusion shall conform to requirements specified in Table II.

TABLE II. Mechanical Properties

Temper	Thickness, (bar and shapes); diameter, (rod and wire); wall thickness (tube) Inches	Tensile Strength Minimum ksi	Yield Strength at 0.2 percent Offset or at extension indicated		Elongation in 2 inches or 4 times D ^{1/} , ^{4/} Minimum percent
			Minimum ksi	Extension under load inch per inch	
O	All	^{2/}	^{2/}	0.0036	16
T1	Up thru 0.625	26.0	14.0	0.0034	16
T4, T4510, and T4511	All	26.0	16.0	0.0036	16
T42 ^{3/}	All	26.0	12.0	0.0032	16
T51	Up thru 0.625	35.0	30.0	0.0050	8
T6, T62 ^{3/} , T6510 and T6511	Up thru 0.249 0.250 and over	38.0	35.0	0.0055	8
		38.0	35.0	0.0055	10

^{1/} D represents specimen diameter.

^{2/} No minimum; maximum tensile and yield strengths are 22.0 ksi and 16.0 ksi, respectively.

^{3/} Material in the T42 or T62 temper is not available from material producers.

^{4/} See AMS-QQ-A-200 for elongation requirement exceptions.

- 3.2.2 Mechanical Properties After Heat Treatment: In addition to conforming to requirements of 3.2.1, materials identified in the following paragraphs shall, after having been heat-treated to other tempers also identified therein, have properties in the extrusion direction conforming to those specified in Table II, as applicable.
- 3.2.2.1 Material in the O Temper: Material in the O temper, without the subsequent imposition of cold work or forming operations, shall, after proper solution heat treatment and natural aging, develop the properties specified in Table II for the T42 temper.
- 3.2.2.2 Material in the T1, T4, T42, T4510 and T4511 Tempers: Material in the T1, T4, T42, T4510, and T4511 tempers shall be age-hardenable artificially to the properties specified for T51, T6, T62, T6510, and T6511 tempers, respectively. Such capability shall be demonstrated when specified (See 6.2).

3.3 Heat Treatment:

Unless otherwise specified in the contract or purchase order for T4, T4510, T4511, T6, T6510, and T6511 material, the producer may use an alternative heat treating procedure in lieu of a furnace heat treatment covered by MIL-H-6088, provided the material conforms to all other requirements of this specification when sampled and tested in accordance with 4.2. The alternative heat treatment shall be performed on the whole of a piece, never on a part only, and shall be performed on the whole of a piece, never a part only, and shall be performed in a manner that will produce the utmost uniformity (See 6.2).

3.4 Marking:

In addition to marking required by AMS-QQ-A-200, material in the T51, T6, T6510, and T6511 tempers and, when specified (See 6.2), material in the T1, T4, T4510, and T4511 tempers, shall also be identified by inspection lot number, marked in at least one location on each piece.

4. QUALITY ASSURANCE PROVISIONS:

See AMS-QQ-A-200 and the following:

4.1 Heat Treatment:

4.1.1 Aging Treatment Before Testing: Test specimens selected from material in the T1, T4, T42, T4510, and T4511 tempers may be tested within 4 days following solution heat treatment. In the event of test failures caused by insufficient aging, retests shall be performed using material aged for 4 days or longer. Test specimens shall be prepared from the same coupons or location in the lot or lots from which the previously tested specimens were taken.

4.2 Additional Sampling and Testing of Material Heat-Treated by Methods Not Covered by MIL-H-6088:

4.2.1 Alloy Heat-Treated to the T6, T6510, or T6511 Tempers: When material in the T6, T6510, or T6511 tempers has not been heat-treated by a method covered by MIL-H-6088, internal quality controls shall be applied to establish that product so-treated meets all requirements of this detail specification and AMS-QQ-A-200. Compliance with the requirements of Table II may be determined by hardness tests followed by tension tests performed on samples from the two softest extrusions in the inspection lot. The method of hardness testing shall be left to the discretion of the producer.

4.2.2 Alloy Heat-Treated to the T4, T4510, or T4511 Tempers: When material in the T4, T4510, or T4511 temper has not been solution heat-treated by a method covered by MIL-H-6088, internal quality controls shall be applied to establish that product so-treated meets all requirements of this detail specification and AMS-QQ-A-200. In addition, specimens taken from extrusions in these tempers shall be artificially aged to determine conformance to 3.2.2.2, as applicable, and be hardness-tested and tension-tested in accordance with 4.2.1. Any specimen blank selected for an age-hardenability determination shall be removed from the softest extrusion in the lot undergoing inspection.