SAE Aerospace
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# AEROSPACE MATERIAL SPECIFICATION

SAE AMS-QQ-A-200/9A

Issued JUL 1997
Cancelled AUG 2007

Superseded by ASTM B 241 and ASTM B 221

## Aluminum Alloy 6063, Bar, Rod, Shapes, Tube, and Wire, Extruded

(Composition similar to UNS A96063)

RATIONALE

AMS-QQ-A-200/9 has been designated Cancelled and Superseded because equivalent technical requirements are provided by ASTM B 241 and ASTM B 221.

CANCELLATION NOTICE

This specification has been declared "CANCELLED" by the Aerospace Materials Division, SAE, as of August, 2007, and has been superseded by the specifications listed below. The requirements of the latest issue of the specifications listed below shall be fulfilled whenever reference is made to the cancelled AMS-QQ-A-200/9. By this action, this document will remain listed in the Numerical Section of the Index of Aerospace Material Specifications, noting that it has been superseded by the specifications listed below.

Cancelled specifications are available from SAE.

| AMS-QQ-A-200/9 | Superseding Specification | Alloy |
|---|---|---|
| Type 1 Tubing | ASTM B 241, Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube | 6063 |
| Type II Tubing and all other product | ASTM B 221, Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes | 6063 |





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## Aluminum Alloy 6063, Bar, Rod, Shapes, Tube, and Wire, Extruded

A96063



NOTICE

This document has been taken directly from Federal Specification QQ-A-200/9D 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 6063 bar, rod, shapes, tube, and wire extruded described herein shall consist of this document and the latest issue of AMS-QQ-A-200.

1. SCOPE AND CLASSIFICATION:

1.1 Scope:

This specification covers the specific requirements for aluminum alloy 6063 bar, rod, shapes, tube, and wire produced by extrusion.



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1.2 Classification:

1.2.1 Tempers: Bar, rod, shapes, tube, and wire are classified in the following tempers as specified (See 6.2). Definitions of tempers are specified in AMS-QQ-A-200.

O - Annealed
T1 - Solution heat-treated and quenched at the extrusion press
T4 - Solution heat-treated and naturally aged to a substantially stable condition
T5 - Artificially aged T1
T6 - Solution heat-treated and artificially aged
T52 - Temper T1 with special artificial aging to control formability

1.2.2 Tubing: Tubing shall be additionally classified as follows:

| Type | Description |
|---|---|
| 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 | 0.45 | 0.9 |
| Silicon | 0.20 | 0.6 |
| Iron | -- | 0.35 |
| Copper | -- | 0.10 |
| Titanium | -- | 0.10 |
| Manganese | -- | 0.10 |
| Zinc | -- | 0.10 |
| Chromium | -- | 0.10 |
| Other Elements, each | -- | 0.05 |
| Other Elements, total 2/ | -- | 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.

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. (See AMS-QQ-A-200 for exceptions to elongation requirements).

TABLE II. Mechanical Properties

| Temper | Thickness, (bar and shapes); diameter, (rod and wire); wall thickness, (tube) Inches | Area Square 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/, Minimum percent |
|---|---|---|---|---|---|---|
| | | | | Minimum ksi | Extension under load, inch per inch | |
| O | All | All | 2/ | --- | --- | 18 |
| T1 | Up thru 0.500 | All | 17.0 | 9.0 | 0.0029 | 12 |
| | 0.501 - 1.000 | | 16.0 | 8.0 | 0.0028 | 12 |
| T4 and T42, 4/ | Up thru 0.500 | All | 19.0 | 10.0 | 0.0030 | 14 |
| | 0.501 - 1.000 | | 18.0 | 9.0 | 0.0029 | 14 |
| T5 | Up thru 0.500 | All | 22.0 | 16.0 | 0.0036 | 8 |
| | 0.501 - 1.000 | | 21.0 | 15.0 | 0.0035 | 8 |
| T6 and T62, 4/ | Up thru 0.124 | All | 30.0 | 25.0 | 0.0045 | 8 |
| | 0.125 - 1.000 | | 30.0 | 25.0 | 0.0045 | 10 |
| T52 | Up thru 1.000 | All | 22.0 3/ | 16.0 3/ | 0.0036 | 8 |

1/ D represents specimen diameter.
2/ No minimum. Maximum tensile strength is 19.0 ksi.
3/ Maximum tensile strength is 30.0 ksi and maximum yield strength is 25.0 ksi.
4/ Material in the T42 and T62 tempers is not available from material producers.



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 artificial aging, develop the properties specified in Table II for the T62 temper. Material solution heat treated as specified in the foregoing sentence shall, after natural aging, demonstrate conformance to the requirements of Table II with respect to the T42 temper when such demonstration is specified (See 6.2).

3.2.2.2 Material in the T1 and T4 Tempers: Material in the T1 and T4 tempers shall be artificially ageable to the properties specified for the T5 and T6 tempers, respectively. Such capability shall be demonstrated when specified (See 6.2).

3.3 Marking:

See AMS-QQ-A-200.

4. QUALITY ASSURANCE PROVISIONS:

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

4.1 Inspection Lot:

See AMS-QQ-A-200 for lot definitions.

4.2 Heat Treatment:

4.2.1 Aging Period Before Testing: Material solution heat treated and selected for natural aging may be tested for compliance with 3.2.2 within 4 days after solution heat treatment, if the manufacturer so elects. It these tests fail, the manufacturer may test additional specimens taken after 4 days aging. These specimens shall be taken from the same location in the inspection lot from which the first specimens were taken.

4.3 Mechanical Tests After Heat Treatment:

4.3.1 Material in the O Temper: From material in the O temper, an additional number of specimens, equal to those required by AMS-QQ-A-200, shall be taken and tested after solution heat treatment and artificial aging to determine compliance with 3.2.2.1 with respect to the T62 temper. When specified (See 6.2), an additional number of specimens from material in the O temper, equal to those required by AMS-QQ-A-200, shall be taken and tested after solution heat treatment to determine compliance with 3.2.2.1 with respect to the T42 temper.

4.3.2 Material in the T1 and T4 Tempers: When specified (See 6.2), an additional number of specimens from material in the T1 and T4 tempers, equal to those required by AMS-QQ-A-200, shall be taken and tested after the appropriate artificial aging treatments to determine compliance with 3.2.2.2, as applicable.

5. PREPARATION FOR DELIVERY:

See AMS-QQ-A-200.