QQ-A-200/8F
8 November 1983
SUPERSEDING
QQ-A-200/8E
April 7, 1981

FEDERAL SPECIFICATION

ALUMINUM ALLOY 6061, BAR, ROD, SHAPES, TUBE AND WIRE, EXTRUDED

This specification was approved by the Assistant Administrator, office of Federal Supply and Services, General Services Administration, for the use of all Federal agencies.

The complete requirements for procuring the aluminum alloy 6061, bar, rod, shapes, tube and wire, extruded described herein shall consist of this document the latest issue of QQ-A-200/GEN (see 2.1).

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. The bar, rod, shapes, tube and wire shall be of the following tempers O, T1, T4, T42, T4510, T4511, T51, T6, T62, T6510 or T6511, as specified (see 6.2). The definition of these tempers shall be as specified in QQ-A-200/GEN.

1.2.2 Type. Tubing shall be additionally classified as follows:

Type		Description
I	-	Tubing extruded from hollow billets using die and mandrel (see QQ-A-200/GEN)
II	-	Tubing extruded from solid billets using a porthole or spider die or similar tooling (see QQ-A-200/GEN)

2. APPLICABLE DOCUMENTS

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

FSC 9530, 4710
9525, 9540

Federal Specifications

QQ-A-200/GEN - Aluminum Alloy, Bar, Rod, Shapes, Structural Shapes, Tube and Wire, Extruded; General Specification for

(Activities outside the Federal Government may obtain copies of Federal specifications, standards, and commercial item descriptions, as outlined under General Information in the Index of Federal Specifications, Standards and Commercial Item Descriptions. The Index, which includes cumulative bimonthly supplements as issued, is for sale on a subscription basis by the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.)

(Single copies of this specification, and other Federal specifications and commercial item descriptions required by activities outside the Federal Government for bidding purposes are available without charge from General Services Administration Business Service Centers in Boston, MA; New York, NY; Philadelphia, PA; Washington, DC; Atlanta, GA; Chicago, IL; Kansas City, MO; Fort Worth, TX; Houston, TX; Denver, CO; San Francisco, CA; Los Angeles, CA; and Seattle, WA.)

(Federal Government activities may obtain copies of Federal standardization documents and the index of Federal Specifications, Standards, and Commercial Item Descriptions from established distribution points in their agencies.)

Military Specifications

MIL-H-6088 - Heat Treatment of Aluminum Alloys

Military Standards

MIL-STD-105 - Sampling Procedures and Table for Inspection by Attributes

(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.)

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, each	--	0.05
Other, 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 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 the requirements specified in table II.

3.2.2 Mechanical properties after heat treatment. In addition to conforming to the 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 the T51, T6, T62, T6510 and T6511 tempers, respectively. Such capability shall be demonstrated when specified (see 6.2).

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,	
0	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 38.0	35.0 35.0	0.0055 0.0055	8 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 the materials producers
[4] See QQ-A-200/GEN for elongation requirement exceptions

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 QQ-A-200/GEN, material in the T51, T6510 and T6511 tempers and, when specified (see 6.2), material in the T1, T4, T4510 and T4511 tempers, shall also be identified by lot number, marked in at least, one location on each piece.

4. QUALITY ASSURANCE PROVISIONS (see QQ-A-200/GEN)

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 QQ-A-200/GEN. 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 QQ-A-200/GEN. 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.

4.3 Number of tests after heat treatment. From material in each temper of those specified for heat treatment capability demonstrations in 3.2.2 and the purchase documents (see 6.2), an additional number of specimens equal to that required by QQ-A-200/GEN shall be taken and tested after heat treatment to each temper specified to determine conformance to 3.2.2.

5. PREPARATION FOR DELIVERY (see QQ-A-200/GEN)

6. NOTES

6.1 Intended use. This alloy is intended for use where good strength and workability are required. The T4510 and T6510 tempers are intended primarily to provide material with low residual stresses and consequent minimum distortion during machining. The T4511 and T6511 tempers are straightened T4510 and T6510 material, respectively, and may have unknown residual stresses and may or may not distort during machining.

6.1.1 Mechanical properties after solution heat treatment. Material in the T1, T4511, T51, T6, T6510 and T6511 tempers may not meet the requirements of table II for T42 temper after re-solution heat treatment because of a tendency for grain growth.

6.2 Ordering data. Purchasers should select the preferred options permitted herein, and include the following information in procurement documents:

(a) Title, number and date of this specification
(b) Form, quantity and temper required (see 1.2.1)
(c) Dimensions required
(d) Requirements for sizes not specifically covered (see QQ-A-200/GEN)
(e) When lot number marking for material in the T1, T4, T4510 or T4511 temper is required (see 3.4)
(f) Which, if any, heat treatment capabilities shall be demonstrated where such demonstrations are purchaser's options (see 3.2.2.2)
(g) Whether heat treatments not covered by MIL-H-6088 are disallowed (see 3.3)
(h) Special end use requirements
(i) Selection of applicable levels of preservation and packing, whether level A, level B or commercial (see QQ-A-200/GEN)
(j) Whether type I tubing is required (see 1.2.2); (where no type is specified, type I should be applied)

6.3 International standardization agreements. 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 affects or violates the international agreement concerned, the preparing activity will inform GSA so that appropriate reconciliation action may be taken through international standardization channels.

6.4 Properties after heat treatment. Mechanical properties and corrosion properties, where applicable, are certified for the temper of material supplied. The producer's capability demonstration is not evidence that user-treated material conforms to property requirements of a given temper. Frequently, user-heat-treated material may develop a lower level of properties, especially if any cold, warm or hot work is introduced, prior to solution heat treatment. The user should be held responsible for demonstration that his processing will yield properties meeting requirements.

MILITARY INTEREST:

Custodians

Army-MR
Navy-AS
Air Force-20

Review Activities

Army-AR, EA, MI
Air Force-99
DLA-IS

User Activities

Army-ME
Navy-EC, MC, SH

CIVIL AGENCY COORDINATING ACTIVITIES:

GSA-FSS
NASA-JFK, MSF
DOE-BPA

PREPARING ACTIVITY:

NAVY-AS

DOD Project 0.530-0231

Orders for this publication are to be placed with the General Services Administration, acting as an agent for the Superintendent of Documents. See Section 2 of this specification to obtain extra copies and other documents referenced herein.

U.S. GOVERNMENT PRINTING OFFICE: 1983 - 705.040/5613

INCH-POUND

NOTICE
OF VALIDATION

QQ-A-200/8F
NOTICE 1
30 October 1991

FEDERAL SPECIFICATION SHEET

ALUMINUM ALLOY 6061, BAR, ROD, SHAPES, TUBE AND WIRE, EXTRUDED

QQ-A-200/8F, dated 8 November 1983, has been reviewed and determined to be valid for use in acquisition.

Custodian
Army - MR
Navy - AS
Air Force - 11

Preparing activity:
Navy - AS

AMSC N/A

FSC 9530

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