

QQ-A-200/3F
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SUPERSEDING
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FEDERAL SPECIFICATION SHEET

ALUMINUM ALLOY 2024, 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 2024, bar, rod, shapes, tube and wire, extruded described herein shall consist of this document and 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 2024, 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, as specified (see 6.2): 0, T3, T42, T3510, T3511, T81, T8510 or T8511. 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 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.

Federal Specifications

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

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(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 Center 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 points in their agencies.)

Military Standards

MIL-STD-2154 - Inspection, Ultrasonic, Wrought Metals, Process for

(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.

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.

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TABLE I. Chemical Composition [1]

Element	Percent	
	Minimum	Maximum
Copper	3.8	4.9
Magnesium	1.2	1.8
Manganese	0.30	0.9
Iron	--	0.50
Silicon	--	0.50
Zinc	--	0.25
Chromium	--	0.10
Titanium	--	0.15
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

3.2.2.1 Material in the 0 temper. Material in the 0 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 T3, T3510, T3511, T81, T8510 and T8511 tempers. Material in the T3, T3510, T3511, T81, T8510 and T8511 tempers shall, without the subsequent imposition of cold work or forming operations, be capable of being re-solution heat-treated and naturally aged to the properties specified for the T42 temper. Such capability shall be demonstrated when specified (see 6.2).

3.2.2.3 Material in the T3, T3510 and T3511 tempers. Material in the T3, T3510 and T3511 tempers shall be hardenable by artificial aging to the properties specified for the T81, T8510 and T8511 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	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 <u>1/</u> , <u>2/</u> Minimum, percent
				Minimum, ksi	Extension under load, inch per inch	
0	All	All	<u>2/</u>	<u>2/</u>	0.0038	12
T3 <u>8/</u>	Up to 0.249, incl.	All	57.0	42.0	0.0060	12 <u>5/</u>
T3510 <u>9/</u>	0.250 to 0.749, incl.	All	60.0	44.0	0.0062	12 <u>5/</u>
T3511 <u>9/</u>	0.750 to 1.499, incl.	All	65.0	46.0	0.0063	10
	1.500 and over	Up thru 25	70.0	52.0 <u>3/</u>	0.0069	10
	1.500 and over	Over 25 thru 32	68.0	48.0 <u>4/</u>	0.0065	8
T42 <u>6/</u>	Up to 0.749, incl.	All	57.0	38.0	0.0056	12
	0.750 to 1.499, incl.	All	57.0	38.0	0.0056	10
	1.500 and over	Up thru 25	57.0	38.0	0.0056	10
	1.500 and over	Over 25 thru 32	57.0	38.0	0.0056	8
T81,	0.050 to 0.249, incl.	All	64.0	56.0	0.0073	4
T8510 <u>9/</u> ,	0.250 to 1.499, incl.	All	66.0	58.0	0.0075	5
T8511 <u>9/</u>	1.500 and over	Up thru 32	66.0	58.0	0.0075	5

TABLE II. Mechanical properties - Continued

- [1] D represents specimen diameter
- [2] No minimum. Maximum tensile and yield strengths shall be 35.0 ksi and 19.0 ksi, respectively
- [3] For tube, minimum yield strength is 48.0 ksi and extension under load is 0.0065 inch per inch
- [4] For tube, minimum yield strength is 46.0 ksi and extension under load is 0.0063 inch per inch
- [5] For tube, minimum elongation is 10 percent
- [6] Material in the T42 temper is not available from the materials producers
- [7] See QQ-A-200/GEN for elongation requirement exceptions
- [8] The properties specified for the T3 temper are those formerly specified for the T4 temper
- [9] For stress-relieved tempers, the characteristics and properties, other than those specified, may differ somewhat from the corresponding characteristics and properties of the material in the basic temper

3.3 Internal defects. When specified (see 6.2), bar, rod, tube and shapes shall be ultrasonically inspected (see QQ-A-200/GEN). Acceptance limits shall be as specified in table III. The technique for testing tubes shall be as agreed upon by the procuring activity and the contractor (see 6.2).

TABLE III. Ultrasonic discontinuity acceptance limits [1], [3]

Thickness, (bar and shapes); diameter, (rod); wall thickness, (tube)	Maximum weight per piece,	Maximum width to thickness ratio	Discontinuity class
inches [4]	pounds		[2]
0.500 and over	600	10 to 1	B

- [1] Discontinuities in excess of those listed in table III may be allowed subject to the approval of the procuring activity, if it is established that they will be removed by machining or that they are in noncritical areas
- [2] The discontinuity class limits are defined in MIL-STD-2154
- [3] Requirements for ultrasonic inspection for sizes, maximum weights and discontinuity classes differing from those shown in table III and for rod shall be specified in the contract provided the techniques and standards are agreed to by the procuring activity and the producer (see 6.2)
- [4] For thickness of a shape, see definition for shape in QQ-A-200/GEN

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3.4 Marking. In addition to the marking required by QQ-A-200/GEN, material in the T81, T8510, T8511, T3, T3510 and T3511 tempers shall also be identified by a 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. Specimens selected for treatment to T3, T3510, T3511 and T42 tempers may be tested within 4 days after completion of the solution heat treatment. If these tests fail, the manufacturer may elect to test additional specimens from the same sample lot after the expiration of at least 4 days after the date of solution heat treatment. These specimens shall be taken from the same location in the lot as the prior specimens.

4.2 Mechanical tests after heat treatment.

4.2.1 Number of tests after heat treatment. From material in the 0 temper, additional sets of specimens equal in the number to those required by QQ-A-200/GEN shall be taken and tested after solution heat treatment to determine compliance with 3.2.2.1. When specified (see 6.2), from material in a temper other than the 0 temper, an additional number of specimens equal to those specified by QQ-A-200/GEN shall be taken and tested after re-solution treatment, where specified, and the appropriate aging treatment to determine compliance with 3.2.2.2 or 3.2.2.3, as applicable.

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

6. NOTES

6.1 Intended use. This alloy is intended for use where high strength is required and no welding is involved. Tempers T3, T42, T3510 and T3511 should not be used where optimum corrosion resistance is required. Tempers T81, T8510 and T8511 should be specified when optimum resistance to stress corrosion is required. The T3510 and T8510 tempers are intended primarily to provide material with low residual stresses and consequent minimum distortion during machining. The T3511 and T8511 tempers are straightened T3510 and T8510 material, respectively, and may have unknown residual stresses and may or may not distort during machining.

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

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- (d) Requirements for sizes not specifically covered (see QQ-A-200/GEN)
- (e) Demonstrations of heat treatability of alloy in tempers other than 0 temper
- (f) Whether ultrasonic inspection of bar, rod and shapes is required (see 3.3)
- (g) Special end use requirements
- (h) Selection of applicable levels of preservation and packing, whether level A, level B, or commercial (see QQ-A-200/GEN)
- (i) Whether type II tubing may be applied (see 1.2.2)

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 requirements.

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 demonstrating that his processing will yield properties meeting requirements.

MILITARY INTEREST:

CIVIL AGENCY COORDINATING ACTIVITIES:

Custodians

GSA-FSS
NASA-JFK, MSF
DOE-BPA

Army-MR
Navy-AS
Air Force-20

PREPARING ACTIVITY:

Review Activities

NAVY-AS

Army-AR, EA, MI
DLA-IS

DOD Project 9530-0227

User Activities

Army-CR
Navy-MC, SH

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