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SUPERSEDING
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FEDERAL SPECIFICATION SHEET

ALUMINUM ALLOY 7178, BAR, ROD, SHAPES, TUBE AND WIRE, EXTRUDED

This specification was approved by the Assistant Administrator,
Office of Federal Supply and Services, General Services Admin-
istration, for the use of all Federal agencies.

The complete requirements for procuring the aluminum alloy 7178, 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 7178 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, T6 1/, T62, T6510 and T6511. The definition of these tempers shall be as specified in QQ-A-200/GEN.

1/ Alloy 7178 in the T6 temper shall not be used for new aerospace design or application without the prior approval of the procuring activity (see 6.1 and 6.2)

1.2.2 Type. Tubing shall be additionally classified as follows:

<u>Type</u>	<u>Description</u>
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, 9525,
4710, 9540

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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 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 (see QQ-A-200/GEN for exceptions to elongation requirements).

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.

TABLE I. Chemical composition 1/

Element	Percent	
	Minimum	Maximum
Zinc	6.3	7.3
Magnesium	2.4	3.1
Copper	1.6	2.4
Chromium	0.18	0.28 <u>2/</u>
Manganese	--	0.30
Iron	--	0.50
Silicon	--	0.40
Titanium	--	0.20
Other elements, each	--	0.05
Other elements, total <u>3/</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 specified limits
- 2/ Material on hand which has a chromium content in excess of 0.28 percent, but not more than 0.35 percent, may be used unless otherwise specified (see 6.2)
- 3/ 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 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.

3.2.2.2 Material in the T6, T6510 and T6511 tempers. Material in the T6, T6510 and T6511 tempers, without the subsequent imposition of cold work or forming operations, shall be capable of being re-solution-treated and artificially aged to the properties specified for the T62 temper. Such capability shall be demonstrated when specified (see 6.2).

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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, Minimum, ksi	Elongation in 2 inches or 4 times D ^{1/} ,
0	All	Up thru 32	^{2/}	^{2/}	10
T6, T6510 3/, and T6511	Up thru 0.061	All	82.0	76.0	--
	0.062 - 0.249	Up thru 20	84.0	76.0	5
	0.250 - 1.499	Up thru 25	87.0	78.0	5
	1.500 - 2.499	Up thru 25	86.0	77.0	5
	1.500 - 2.499	Over 25 thru 32	84.0	75.0	5
T62 ^{4/}	2.500 - 2.999	Up thru 32	82.0	71.0	5
	Up thru 0.061	All	79.0	73.0	--
	0.062 - 0.249	Up thru 20	82.0	74.0	5
	0.250 - 1.499	Up thru 25	86.0	77.0	5
	1.500 - 2.499	Up thru 25	86.0	77.0	5
	1.500 - 2.499	Over 25 thru 32	84.0	75.0	5
	2.500 - 2.999	Up thru 32	82.0	71.0	5

^{1/} D represents specimen diameter.^{2/} No minimum. Maximum tensile and yield strengths shall be 40.0 ksi and 24.0 ksi, respectively^{3/} For stress-relieved tempers, the characteristics and properties, other than those specified, may differ somewhat from the corresponding characteristics and properties of material in the basic temper^{4/} Material in the T62 temper is not available from the materials producers

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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/}

Thickness, (bar and shapes); diameter, (rod); wall thickness, (tube)	Maximum weight per piece,	Maximum width to thickness ratio	Discontinuity class
inches ^{3/}	pounds	^{4/}	^{2/}
0.500 to 1.499	600	10 to 1	B
1.500 and over	600	10 to 1	A

^{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/} The thickness of any element of a shape shall be deemed to be the smallest dimension of that element, and the discontinuity class applicable to that particular thickness shall apply to that element of the shape

^{4/} Not applicable to rod and tube

3.4 Marking. In addition to the marking required by QQ-A-200/GEN, material in the T6, T6510 and T6511 tempers shall 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 Inspection lot. (See QQ-A-200/GEN for definitions).

4.2 Mechanical tests after heat treatment.

4.2.1 Material in the O temper. From material in the O temper, an additional number of specimens, equal to that required by QQ-A-200/GEN, shall be taken and tested after solution heat treatment and artificial aging to determine compliance with 3.2.2.1.

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4.2.2 Material in tempers other than 0. When specified (see 6.2), from material in a temper, other than the 0 temper, an additional number of specimens, equal to that required by QQ-A-200/GEN, shall be taken and tested after the appropriate re-solution heat treatment and artificial aging treatment to determine compliance with 3.2.2.2.

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 where good resistance to general corrosion is not important. This alloy is noted for its high transverse properties, especially its high elongation values. The T6510 temper is intended primarily to provide extruded materials with low residual stresses and consequent minimum distortion during machining. The T6511 temper is straightened T6510 material and may or may not distort during machining. Alloy 7178 in the T6 temper should not be applied where service environments may cause stress corrosion cracking or exfoliation.

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) Special end use requirements
- (f) Whether 7178 in the T6 temper is allowed for the application (see footnote 1/, 1.2.1)
- (g) Whether type I tubing is required (see 1.2.2)
- (h) Whether an alloy having a chromium concentration in the 0.29 - 0.35 percent range shall not be used (see table I)
- (i) Demonstrations of heat treatability where such demonstrations are purchaser's option (see 3.2.2.2)
- (j) Whether ultrasonic inspection of material is required (see 3.3). Requirements for sizes, maximum weights and discontinuity classes not covered in table III. Method of inspecting tube, where applicable
- (k) For military agencies - selection of applicable levels of preservation, packaging and packing required. Also specify marking requirements (see section 5, QQ-A-200/GEN)
- (l) For civil agencies - specify packing level, level A or commercial. Also specify marking requirements (see section 5, QQ-A-200/GEN)

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6.3 Properties after heat treatment. Mechanical properties 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:

Custodians

Army-MR
Navy-AS
Air Force-20

Review Activities

Army-MI
DLA-IS

User Activities

Army-CR
Navy-MC, YD

CIVIL AGENCY COORDINATING ACTIVITIES:

GSA-FSS
NASA-JFK
DOE-BPA

PREPARING ACTIVITY:

NAVY-AS

DOD Project 9530-0234

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.