WW-T-700/6F
29 December 1983
SUPERSEDING
WW-T-700/6E
September 5, 1972

FEDERAL SPECIFICATION SHEET

TUBE, ALUMINUM ALLOY, DRAWN, SEAMLESS, 6061

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 seamless tube drawn from aluminum alloy 6061 described herein shall consist of this document and the latest issue of WW-T-700/GEN (see 2.1).

1. SCOPE AND CLASSIFICATION

1.1 Scope. This specification covers the specific requirements for seamless tube drawn from aluminum alloy 6061.

1.2 Classification.

1.2.1 Tempers. The drawn seamless tube shall be of the following tempers: O, T4, T42, T6, T62, or F, as specified (see 6.2 and 6.3). The definition of these tempers shall be as specified in WW-T-700/GEN.

1.2.2 Types. The tube shall be of the following types:

Type		Appearance
I	-	Round
II	-	Rectangular and square
III	-	Streamline
IV	-	Oval
V	-	Odd shapes

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 Specification

WW-T-700/GEN - Tube, Aluminum and Aluminum Alloy, Drawn, Seamless, 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 Commerical 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 the 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.)

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
Silicon	0.40	0.8
Iron	-	0.7
Copper	0.15	0.40
Manganese	-	0.15
Magnesium	0.8	1.2
Chromium	0.04	0.35
Zinc	-	0.25
Other elements, each	-	0.05
Other elements, total	-	0.15
Aluminum	Remainder	

1/ Except for "Aluminum" and "Others", analysis normally is made for elements for which specific limits are shown

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 Tensile strength, yield strength and elongation properties. The tensile strength, yield strength and elongation mechanical properties parallel to the direction of drawing shall conform to the requirements specified in table II.

TABLE II. Tensile strength, yield strength and elongation properties

Temper	Wall thickness, inch	Tensile strength, minimum, ksi	Yield strength		Percent elongation in 2 inches or 4D 1/, minimum, kind of specimen	
			At 0.2 percent, offset, minimum, ksi	At extension under load, inch per inch	Full section	Cut-out
O	0.018 to 0.500, incl.	22.0 2/	14.0 2/	0.0024	15	15
T4	0.025 to 0.049, incl.	30.0	16.0	0.0036	16	14
	0.050 to 0.259, incl.	30.0	16.0	0.0036	18	16
	0.260 to 0.500, incl.	30.0	16.0	0.0036	20	18
T42 3/	0.025 to 0.049, incl.	30.0	14.0	0.0024	16	14
	0.050 to 0.259, incl.	30.0	14.0	0.0024	18	16
	0.260 to 0.500, incl.	30.0	14.0	0.0024	20	18
T6 and T62 3/	0.025 to 0.049, incl.	42.0	35.0	0.0055	10	8
	0.050 to 0.259, incl.	42.0	35.0	0.0055	12	10
	0.260 to 0.500, incl.	42.0	35.0	0.0055	14	12
F	All	4/	4/	4/	4/	4/

1/ Round tube 2 inches or less in outside diameter and square tube 1-1/2 inches or less on a side shall be tested in full section unless the limitations of the testing machine preclude the use of such a specimen. For round tube over 2 inches in diameter, for square tube over 1-1/2 inches on a side, for all sizes of tube other than round or square, or in those cases when a full section specimen cannot be used, a cut-out specimen shall be used. D represents diameter of cut-out specimen

2/ Maximum

3/ Material in the T42 or T62 tempers is not available from the materials producers

4/ No requirements

3.2.2 Flattening. When specified (see 6.2), round tube (type 1) in O, T4, and T6 tempers shall withstand, without cracking, the flattening test or the alternative bend test specified in WW-T-700/GEN. The values for flattening factor "F" are specified in table III.

TABLE III. Flattening factor

Temper	Wall thickness, inch	F
O	Up through 0.120	3
	0.121 to 0.238, incl.	4
	0.239 to 0.500, incl.	6
T4	0.025 to 0.500, incl.	6
T6	0.025 to 0.500, incl.	8

3.2.2.1 Alternative bending factor "N". The values for the alternative bending factor "N" are specified in table IV.

TABLE IV. Bending factor

Temper	Wall thickness, inch	N
O	0.120 and less	1
	Over 0.120 to 0.238, incl.	2
	Over 0.238 to 0.500, incl.	4
T4	0.025 to 0.500, incl.	4
T6	0.025 to 0.500, incl.	6

3.2.2 Cleanliness. When specified (see 6.2), the internal surface of the tube shall be examined for cleanliness as specified in WW-T-700/GEN.

3.2.3 Leak test. When specified (see 6.2), round tube (type I) shall withstand either the pressure test or the electromagnetic (eddy current) test specified in WW-T-700/GEN.

3.2.4 Flaring. When specified (see 6.2), round tube (type I) in the O, T4 and T42 tempers shall be capable of being flared as specified in WW-T-700/GEN.

3.2.5 Mechanical properties after heat treatment. In addition to conforming to the requirements of 3.2.1, material in the tempers identified in the following paragraphs shall, after having been processed to tempers also specified therein, have properties conforming to those specified in Table II, as applicable.

3.2.5.1 Material in the O and F tempers. Material in the O and F tempers, without the subsequent imposition of cold work or forming operations, shall, after proper solution heat treatment and natural aging, develop the properties specified for the T42 temper.

3.2.5.2 Material in the T4 and T6 tempers. Material in the T4 and T6 tempers, without the subsequent imposition of cold work or forming operations, shall be heat treatable to the properties specified for the T42 temper. Tube in the T42 temper shall be precipitation heat treatable to the properties specified for the T62 temper. Such capabilities shall be demonstrated when specified (see 6.2 and 6.3).

3.3 Marking. In addition to the marking required by WW-T-700/GEN, material in the T6 temper shall also be identified by lot number marked in at least one location on each piece.

4. QUALITY ASSURANCE PROVISIONS (see WW-T-700/GEN)

4.1 Heat treatment.

4.1.1 Aging period before testing. Specimens in the T4 and T42 tempers will not be required to be tested within 4 days after completion of the solution heat treatment. If, within this period, the manufacturer elects to test specimens, which thereupon fail to meet the requirements, he can discard these initial test results and test additional specimens selected after 4 days of aging. These specimens shall be selected from the same location in the production lot or sample as those tested previously.

4.1.2 Sampling for heat treatability. From material in each temper of those specified for heat treatability demonstrations in 3.2.5 and 6.2, an additional number of specimens equal to that required by WW-T-700/GEN shall be taken and tested after heat treatment to each temper specified, as applicable, to determine conformance to 3.2.5.

5. PREPARATION FOR DELIVERY (see WW-T-700/GEN)

6. NOTES

6.1 Intended use. This tube is intended for use when moderate strength, good weldability, good corrosion resistance and workability are required. This tubing is applicable for use in transfer of hydraulic/pneumatic mediums up to a maximum of 3000 psi.

6.1.1 Mechanical properties after re-solution heat treatment. Material in the T4 and T6 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) Temper of material required (see 1.2.1)
(c) Type of tube required (see 1.2.2)
(d) Whether round tube (type 1) in O, T4 and T6 tempers should withstand flattening (see 3.2.2)
(e) Whether round tube (type I) should withstand leak test (see 3.2.3)
(f) Whether O temper round tubes (type I) should withstand flaring test (see 3.2.4)
(g) Dimensions required
(h) Requirements for sizes not specifically covered (see WW-T-700/GEN)

(i) Whether demonstration of capability to develop properties in tempers other than those supplied is required (see 3.2.5).
(j) When the internal surface of the tube shall be examined for cleanliness (see 3.2.2.2)
(k) Selection of applicable levels of preservation and packing (see WW-T-700/GEN)

6.3 Mechanical properties after heat treatment. Mechanical propertes of producer-supplied material 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 heat treatment. The user should be held responsible for demonstrating that his processing is acceptable.

MILITARY INTEREST:

Custodians

Army-MR
Navy-AS
Air Force-20

Review Activities

Army-AR, EA, ME
Navy-OS, SH
Air Force-99
DLA-CS

User Activities

Army-MI
Navy-MC

CIVIL AGENCY COORDINATING ACTIVITIES:

GSA-FSS
COMMERCE-NBS
HEW-FEC
NASA-KSC, MSF
USDA-AFS

PREPARING ACTIVITY:

NAVY-AS

DoD Project 4710-0712

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.

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STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

(See Instructions - Reverse Side)

1. DOCUMENT NUMBER	2. DOCUMENT TITLE
WW-T-700/6F	TUBE, ALUMINUM ALLOY, DRAWN, SEAMLESS, 6061

3a. NAME OF SUBMITTING ORGANIZATION	4. TYPE OF ORGANIZATION *(Mark one)*
	☐ VENDOR ☐ USER ☐ MANUFACTURER ☐ OTHER *(Specify)*: _____
b. ADDRESS *(Street, City, State, ZIP Code)*	

5 PROBLEM AREAS

a. Paragraph Number and Wording:

b. Recommended Wording.

c. Reason/Rationale for Recommendation.

6. REMARKS

7a. NAME OF SUBMITTER *(Last, First, MI)* - Optional	b. WORK TELEPHONE NUMBER *(Include Area Code)* - Optional
c. MAILING ADDRESS *(Street, City, State, ZIP Code)* - Optional	8. DATE OF SUBMISSION *(YYMMDD)*

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