QQ-A-250/11F
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SUPERSEDING
QQ-A-250/11E
August 27, 1971

FEDERAL SPECIFICATION SHEET

ALUMINUM ALLOY 6061, PLATE AND SHEET

This specification is approved by the Commissioner, Federal Supply Service, General Services Administration, for the use of all Federal agencies.

The complete requirements for procuring aluminum alloy 6061 plate and sheet described herein shall consist of this document and the latest issue of QQ-A-250/GEN (see 2.1).

1. SCOPE AND CLASSIFICATION

1.1 Scope. This specification covers the specific requirements for aluminum alloy 6061 plate and sheet.

1.2 Classification.

1.2.1 Tempers. The plate and sheet shall be classified as O, T4, T6, T42, T62, T451, T651, or F temper, as specified (see 6.2).

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-250/GEN	- Aluminum and Aluminum Alloy Plate and Sheet; 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.)

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	0.80	1.20
Silicon	0.40	0.80
Copper	0.15	0.40
Chromium	0.04	0.35
Iron	-	0.70
Titanium	-	0.15
Manganese	-	0.15
Zinc	-	0.25
Other elements, each	-	0.05
Other elements, total	-	0.15
Aluminum	Remainder	

[1] Analysis shall regularly be made only for the elements specifically mentioned in the Table. If, however, the presence of other elements is indicated in the course of routine analysis, further analysis shall be made to determine conformance to the limits specified for other elements.

3.2 Mechanical properties.

3.2.1 Mechanical properties of material as supplied. The mechanical properties perpendicular to the direction of final rolling, except for material less than 9 inches in width, shall conform to the requirements of Table II for the temper specified. For material less than 9 inches in width, the mechanical properties parallel to the direction of final rolling shall conform to the requirements of Table II for temper specified.

TABLE II. Mechanical properties

Temper	Thickness inches	Tensile strength	Yield strength at 0.2 percent offset or at extension indicated		Elongation in 2 in. or 4 times D[1];[2]
		minimum ksi	minimum ksi	Extension under load inch/inch	
O	0.006 to 0.007, incl.	22.0[3]	12.0[3]	0.0032	10
	over .007 to .009, incl.	22.0[3]	12.0[3]	.0032	12
	over .009 to .020, incl.	22.0[3]	12.0[3]	.0032	14
	over .020 to .128, incl.	22.0[3]	12.0[3]	.0032	16
	over .128 to .499, incl.	22.0[3]	12.0[3]	.0032	18
	.500 to 1.00, incl.	22.0[3]	-	-	18
	over 1.00 to 3.00, incl.	22.0[3]	-	-	16
T4	0.006 to 0.007, incl.	30.0	16.0	0.0036	10
	over .007 to .009, incl.	30.0	16.0	.0036	12
	over .009 to .020, incl.	30.0	16.0	.0036	14
	over .020 to .249, incl.	30.0	16.0	.0036	16
T42[4]	0.006 to 0.007, incl.	30.0	14.0	0.0034	10
	over .007 to .009, incl.	30.0	14.0	.0034	12
	over .009 to .020, incl.	30.0	14.0	.0034	14
	over .020 to .249, incl.	30.0	14.0	.0034	16
	.250 to 1.00, incl.	30.0	14.0	.0034	18
	over 1.000 to 3.000, incl.	30.0	14.0	.0034	16
T451[6]	0.250 to 1.00 incl.	30.0	16.0	0.0036	18
	over 1.000 to 3.000, incl.	30.0	16.0	.0036	16
T6 and T62[4]	0.006 to 0.007, incl.	42.0	35.0	0.0055	4
	over .007 to .009, incl.	42.0	35.0	.0055	6
	over .009 to .020, incl.	42.0	35.0	.0055	8
	over .020 to .249, incl.	42.0	35.0	.0055	10
T651[6] and T62[4]	0.250 to 0.499, incl.	42.0	35.0	0.0055	10
	0.500 to 1.000, incl.	42.0	35.0	.0055	9
	over 1.000 to 2.000, incl.	42.0	35.0	.0055	8
	over 2.000 to 3.000, incl.	42.0	35.0	.0055	6
	over 3.000 to 4.000, incl.	42.0	35.0	.0055	6
T651	over 4.000 to 6.000, incl	40.0	35.0	.0055	6
F	All	[5]	[5]	[5]	[5]

[1] Specimen diameter.

[2] Not required for material 1/2 inch or less width.

[3] Maximum.

[4] Material in the T42 or T62 temper is not available from the materials producers.

[5] No requirements.

[6] Tempers T451 and T651 are available in plate only.

3.2.2 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 heat-treated to other tempers also identified therein, have properties conforming to those specified in Table II, as applicable.

3.2.2.1 Material in the annealed (O) and as-fabricated (F) tempers. Material in the O or F tempers without the subsequent imposition of cold working or forming operations shall, after proper solution heat treatment and natural aging, develop the properties specified in Table II for the T42 temper. When specified (see 6.2), material in the O and F tempers, without the subsequent imposition of cold working or forming operations, shall, after proper solution treatment and artificial aging, develop the properties specified in table II for the T62 temper.

3.2.2.2 Material in the T4, T6, T451 and T651 tempers. When specified (see 6.2), material in the T4, T6, T451 and T651 tempers shall, without the subsequent imposition of cold working or forming operations, and after proper solution heat treatment and natural aging, develop the properties specified in table II for the T42 temper.

3.2.2.3 Material in the T4 and T451 tempers. When specified (see 6.2), material in the T4 and T451 tempers shall, after proper artificial aging, develop the properties specified in Table II for the T6 and T651 tempers, respectively.

3.2.2.4 Material in the T42 temper. When specified (see 6.2), material in the T42 temper shall, after proper artificial aging, develop the properties specified in Table II for the T62 temper.

3.2.3 Bend test. Bend test specimens taken from the material shall be capable of withstanding, without cracking, the bend test specified in QQ-A-250/GEN. The values for bend factors N are given in Table III.

TABLE III. Bend factor N values

Thickness (inch)	Tempers		
	O	T4 and T42	T6 and T62
0.006 to 0.020, incl.	0	2	2
over .020 to .036, incl.	1	3	3
over .036 to .064, incl.	1	3	4
over .064 to .128, incl.	1	3	5
over .128 to .249, incl.	2	3	6
.250 to .499, incl.	3	4	7

3.3 Marking. When specified (see 6.2), in addition to the marking required in QQ-A-250/GEN, metal in the T6 and T651 tempers shall be identified by a lot number marked in at least one location on each piece.

4. QUALITY ASSURANCE PROVISIONS (see QQ-A-250/GEN)

4.1 Heat treatment.

4.1.1 Aging period before testing. Specimens in the T4, T42 and T451 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 four days of aging. These specimens shall be selected from the same location in the production lot or sample as those tested previously.

4.2 Mechanical test after heat treatment.

4.2.1 Number of tests after heat treatment. From material in the annealed (O) and as-fabricated (F) tempers, an additional number of specimens, equal to those required by QQ-A-250/GEN, shall be taken and tested after solution heat treatment to determine compliance with 3.2.2.

5. PREPARATION FOR DELIVERY (see QQ-A-250/GEN)

6. NOTES

6.1 Intended use. Alloy 6061 plate and sheet are intended for use where good strength and workability are required. For airframe applications alloy 6061 is considered an inherently corrosion resistant alloy. Welding of alloy 6061 may require special precautions to avoid unsatisfactory properties in weld and heat-affected zones of welded joints. Welding of alloy 6061 is not acceptable to NAVFAC or NAVSEA as a method of joining.

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

(a) Title, number, and date of this specification sheet
(b) Form, quantity and temper required (see 1.2.1)
(c) Dimensions Required
(d) Mechanical properties and dimensional tolerance requirements for sizes not specifically covered
(e) When lot number identification is required (see 3.3)
(f) Specifications of properties required of material in tempers other than that to be supplied
(g) Special end use requirements
(h) Selection of applicable levels of preservation/packaging and packing (see QQ-A-250/GEN)

6.3 International standardization agreement. 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 including departmental standardization offices, if required.

6.4 Mechanical properties after heat treatment. Mechanical properties 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 the acceptability of his processing for the end use.

MILITARY INTERESTS:

Custodians

Army - MR
Air Force - 20

Review activities

Army - AR, ER, MI
Navy - EC, OS, YD
DLA - IS

User activities

Army - ME
Navy - NC

CIVIL AGENCY COORDINATING ACTIVITIES:
GSA - FSS
NASA - MSF
NASA - JFK

PREPARING ACTIVITY

Navy - AS

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