AA 2024

Category Aluminum Alloy
Class Wrought

CHEMICAL COMPOSITION LIMITS (WT.%)

Si 0.50
Fe. 0.50
Cu 3.8-4.9
Mn 0.30-0.9
Mg 1.2-1.8
Cr. 0.10
Zn 0.25
Ti 0.15
Others,
each . . 0.05
total . . 0.15
Balance, Aluminum
Note: Value maximum if range not shown.

MECHANICAL PROPERTIES

Properties	Conditions	T (°C)	Treatment
Density (×1000 kg/m3)	2.77	25	
Poisson's Ratio	0.33	25	
Elastic Modulus (GPa)	70-80	25	
Tensile Strength (Mpa)	185	25	O more
Yield Strength (Mpa)	76		
Elongation (%)	20		
Hardness (HB500)	47	25	O more
Shear Strength (MPa)	125	25	O more
Fatigue Strength (MPa)	90	25	O more

2024 SHEET AND PLATE

Description

Alloy 2024 was introduced by Alcoa in 1931 as an Alclad sheet in the T3 temper. It was the first Al-Cu-Mg alloy to have a yield strength approaching 50,000-psi and generally replaced 2017-T4 (Duralumin) as the predominant 2XXX series aircraft alloy. With its relatively good fatigue resistance, especially in thick plate forms, alloy 2024 continues to be specified for many aerospace structural applications. 2024 variant alloys, such as higher purity 2124 and 2324, with improvements in strength and other specific characteristics, have also found application in critical aircraft structures. An improved sheet alloy for fuselage applications was introduced in 1991. Alclad C188 offers improved fracture toughness and fatigue crack growth while maintaining the strength characteristics of 2024.

Alloy 2024 is available in bare and Alclad sheet and plate product forms in the annealed state and several tempers of T3, T4, and T8 types.

Applications

Alloy 2024 plate products are used in fuselage structurals, wing tension members, shear webs and ribs and structural areas where stiffness, fatigue performance and good strength are required. Sheet products, usually Alclad, are used extensively in commercial and military aircraft for fuselage skins, wing skins and engine areas where elevated temperatures to 250°F (121°C) are often encountered.

Temper

O

Annealed, recrystallized (wrought products only). Applies to wrought alloys which are annealed to obtain the softest temper, and to cast alloys which are annealed to improve ductility and dimensional stability. Often described as "dead soft" metal.

H
Strain-hardened (wrought products only). Applies to products which have their strength increased by strain-hardening, with or without additional thermal treatments to produce a reduction in strength.

T
Thermally treated to produce stable tempers other than F, O or H. Applies to products which are thermally treated, with or without additional strain-hardening, to produce stable tempers.

T3
Solution heat-treated and then cold worked. Applies to alloys which are cold worked to improve strength after solution heat treatment, or in which the effect of cold work in flattening or straightening is significant in mechanical property limits.

T4
Solution heat-treated and naturally aged to a substantially stable condition. Applies to alloys which are not cold worked after solution heat treatment, or in which the effect of cold work in flattening or straightening may not be significant in mechanical property limits. T42 indicates material is solution heat treated from the O or F temper to demonstrate response to heat-treatment, and naturally aged to a substantially stable condition.

TABLE II
MECHANICAL PROPERTIES OF WROUGHT ALUMINUM ALLOYS FOR MACHINING TESTS

Old Alloy Old Temper	Old Alloy New* Temper	New Alloy New Temper	Ultimate Strength psi	Yield Strength psi **	Elongation % in 2 in.	Reduction of area %	Brinnell Hardness No.***	Shearing Strength psi****	Shearing Strength Elongation %
2S-1/2H	2S-H14	1100-H14	17,900	15,300	35.5	68	32	10,730	320
11S-T3	11S-T3	2011-T3	49,400	38,700	18.5	39	97	31,870	1,790
14S-T	14S-T6	2014-T6	71,800	65,000	13.0	25	139	46,500	3,580
17S-T	17S-T4	2017-T4	63,400	42,900	23.5	38	115	0.,670	1,760
24S-T	24S-T4	2024-T4	68,700	49,700	19.0	26	122	41,330	2,170
32S-T	32S-T6	4032-T6	54,500	48,500	8.5	15	115	36,340	4,160
61S-T	61S-T6	6061-T6	43,400	38,800	19.5	51	94	29,300	1,500
75S-T	75S-T6	7075-T6	85,100	76,800	12.5	20	153	51,230	4,160

*Designations since January 1, 1948.
**Set = 0.2%.
***500-kg load on 10-mm ball. Average of tests at center edge and midway between.
****Determined from double-shear test.

THE UNIVERSITY OF MICHIGAN
INDUSTRY PROGRAM OF THE COLLEGE OF ENGINEERING
FORCES AND POWER REQUIRED TO TURN ALUMINUM AND SEVEN ALLOYS
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