

ALLOY DESCRIPTION

Like 2011, this is also a general-purpose alloy for automatic screw machine work. It is stronger than 2011, but harder to machine and does not have the fine chip associated with 2011. It is recommended for heavy-duty parts because of its high strength. Workability is fair, with ductility and formability considered better than 2014. Arc and resistance weldability are satisfactory. Corrosion resistance is fair. It is used for rivets, fasteners and aircraft components.

TYPICAL MECHANICAL PROPERTIES

Temper	Tensile (.500" Dia. Specimen)					Hardness Brinell 500kg 10 mm	Shear		Fatigue*		Modulus	
	Ultimate		Yield		Elongation/4D %		Ultimate Shearing Strength	Endurance Limit - R.R. Moore Type		Modulus of Elasticity		
	KSI	MPa	KSI	MPa				KSI	MPa	KSI	MPa	KSI x 10 ³
0	26	179	10	69	22	45	18	124	13	90	10.5	72.4
T4, T451	62	427	40	276	22	105	38	262	18	124	10.5	72.4

*5 x 10E8 cycles of reversed stress

COMPARATIVE CHARACTERISTICS

Temper	Corrosion Resistance		Cold Workability ³	Machinability ³	Anodize Response ³	Brazeability ⁴	Weldability ⁴		
	General ¹	Stress ²					Gas	Arc	Spot
T4, T451	D	C	C	B	C	D	D	B	B

- Ratings A through E are relative ratings in decreasing order of merit, based on exposures to sodium chloride solution by intermittent spraying or immersion. Alloys with A and B ratings can be used in industrial and seacoast atmospheres without protection. Alloys with C, D and E ratings generally should be protected at least on faying surfaces.
- Stress-corrosion cracking ratings are based on service experience and laboratory tests of specimens exposed to the 3.5% sodium chloride alternate immersion test.
 - A= No known instance of failure in service or in laboratory tests.
 - B= No known instance of failure in service; limited failures in laboratory tests of short transverse specimens.
 - C= Service failures with sustained tension stress acting in short transverse direction relative to grain structure; limited failures in laboratory tests of long transverse specimens.
 - D= Limited service failures with sustained longitudinal or long transverse
- Ratings A through D for Workability (cold), A through E for Machinability and A through C for Anodize Response, are relative ratings in decreasing order of merit.
- Ratings A through D for Weldability and Brazeability are relative ratings defined as follows:
 - A= Generally weldable by all commercial procedures and methods.
 - B= Weldable with special techniques or for specific applications that justify preliminary trials or testing to develop welding procedure and weld performance.
 - C= Limited weldability because of crack sensitivity or loss in resistance to corrosion and mechanical properties.
 - D= No commonly used welding methods have been developed.

APPLICABLE SPECIFICATIONS

Cold Finished	Extruded
ASTM B211	
AMS-QQ-A-225/3	
AMS 4118	

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CHEMICAL COMPOSITION LIMITS

Weight %	Si	Fe	Cu	Mn	Mg	Cr	Zn	Ti	Others	
									Each	Total
Minimum	0.20	-	3.5	0.40	0.40	-	-	-	-	-
Maximum	0.8	0.7	4.5	1.0	0.8	0.10	0.25	0.15	0.05	0.15

TYPICAL PHYSICAL PROPERTIES

Characteristic		English	Metric
Nominal Density (68 °F/20 °C)		0.101 lbs./in. ³	2.80 Mg/m ³
Melting Range		955 °F - 1185 °F	513 °C - 640 °C
Specific Heat (212 °F/100 °C)		-	-
Coefficient of Thermal Expansion	Linear 68 °F-212 °F 20 °C-100 °C	12.7 micro in./in.-°F	22.9 micro m/m -°K
	Volumetric 68 °F/20 °C	3.67 x 10 ⁻⁵ in. ³ /in. ³ -°F	66 x 10 ⁻⁶ m ³ /m ³ -°K
Thermal Conductivity (68 °F/20 °C)	O Temper	112 BTU/ft. - hr. - °F	193 W/m - °K
	T4, T451	77.5 BTU/ft. - hr. - °F	134 W/m - °K
Electrical Conductivity (68 °F/20 °C)	Equal Volume	O Temper	50% IACS
		T4, T451	34% IACS
	Equal Weight	O Temper	159% IACS
		T4, T451	108% IACS