



Toolrite 2011®

Understanding Cold Finished Aluminum Alloys

Alcoa Toolrite 2011®, a cold finished aluminum wrought product, is suggested for applications requiring high productivity and excellent machinability. It is the most free-machining of all aluminum alloys due to the additions of lead and bismuth. Typical applications include auto fuel system componentry, clock parts, gears, machine parts, pipe stems, TV fittings, camera parts, meter shafts, ordnance, industrial connectors, and speedometer components.

The -T3 temper is the choice when high productivity at moderate strength is key. The -T451 temper offers excellent deep hole drilling characteristics at a lower strength level. When higher strength is required, -T8 temper is the preferred choice.

Alcoa Toolrite 2011® offers excellent machinability with high productivity when

machined using single-point or multi-spindle carbide tools on screw machines. The use of a chip breaker is not necessary in most cases. Being the most free-machining of all aluminum screw machine stock alloys, Toolrite 2011® is rated "A" giving very small broken chips and excellent surface finish on the final machined part. Machined finishes in the range of 5 to 10 microinches have been obtained in some applications using carbide tools.

The properties listed in this Alloy Data Sheet represent the best current information for this alloy. In each specific application, the user is expected to evaluate and test the alloy, temper and finishing method. Consult the Material Safety Data Sheet (MSDS) for proper safety and handling precautions when using Toolrite 2011® alloy.

Toolrite 2011® Temper Designations and Definitions

Standard Tempers	Standard Temper Definitions*
T3	Solution heat-treated, cold worked and naturally aged. Applies to products that are cold worked to improve strength after solution heat-treatment, or in which the effect of cold work in flattening or straightening is recognized in mechanical property limits.
T451	Stress-relieved temper. Solution heat-treated and naturally aged. Applies to products that are not cold worked after solution heat-treatment, or in which the effect of cold work in flattening or straightening may not be recognized in mechanical property limits.
T8	Solution heat-treated, cold worked and then artificially aged. Applies to products that are cold worked to improve strength, or in which the effect of cold work in flattening and straightening is recognized in mechanical property limits.

*For further details of definitions, see Aluminum Association's [Aluminum Standards and Data](#) manual and [Temperatures for Aluminum and Aluminum Alloy Products](#).

Toolrite 2011® Chemical Analysis **Liquidus Temperature:** 1180°F **Solidus Temperature:** 1005°F **Density:** 0.102 lb./in.³

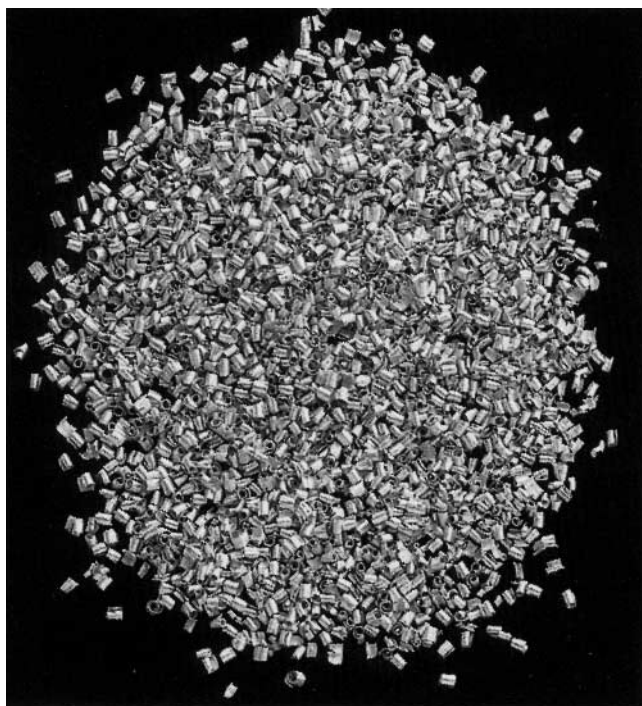
Percent Weight	Elements											Others Each	Others Total	Aluminum
	Si	Fe	Cu	Mn	Mg	Cr	Zn	Ti	Pb	Bi				
Minimum	—	—	5.0	—	—	—	—	—	.20	.20	—	—	—	
Maximum	.40	.7	6.0	—	—	—	.30	—	.6	.6	.05	.15		Remainder

Average Coefficient of Thermal Expansion (68° to 212° F) = 13.0×10^{-6} (inch per inch per °F)

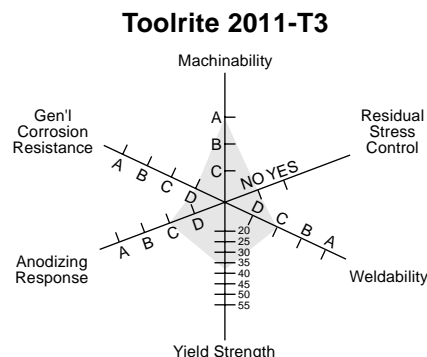
Toolrite 2011® Global Cold Finished Products Capabilities and Mechanical Property Limits

Temper	Specified Section or Wall Thickness ² (inches)	Tensile Strength (ksi)		Elongation ³	Typical Brinell Hardness (500 kg load/ 10 mm ball)	Typical Ultimate Shearing Strength (ksi)	Typical Electrical Conductivity (%IACS)
		Ultimate	Yield (0.2% offset)	Percent Min. in 2 inch or 4D ⁴			
		Min.	Min.				
Standard Tempers ¹							
T3	—	45.0	38.0	10	80	30	45
	.125-1.500	45.0	38.0	10	80	30	45
	1.501-2.000	43.0	34.0	10	80	30	45
	2.001-4.000	42.0	30.0	10	80	30	45
T451 ⁵	—	40.0	18.0	16	95	32	39
	.500-8.000	40.0	18.0	16	95	32	39
T8	—	54.0	40.0	12	100	35	—
	.125-3.250	54.0	40.0	12	100	35	—

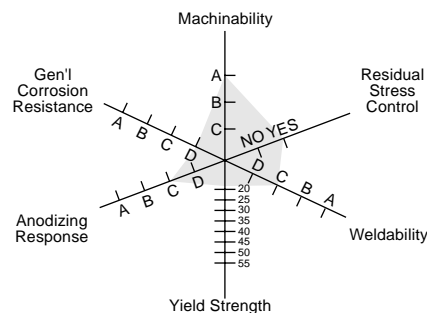
① The mechanical property limits for standard tempers are listed in the "standards section" of the Aluminum Association's Aluminum Standards and Data manual and Tempers for Aluminum and Aluminum Alloy Products. ② The thickness of the cross section from which the tension test specimen is taken determines the applicable mechanical properties. ③ For material of such dimensions that a standard test specimen cannot be obtained, or for shapes thinner than 0.062", the test for elongation is not required. ④ D = Specimen diameter. ⑤ 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.



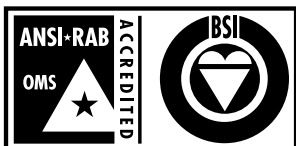
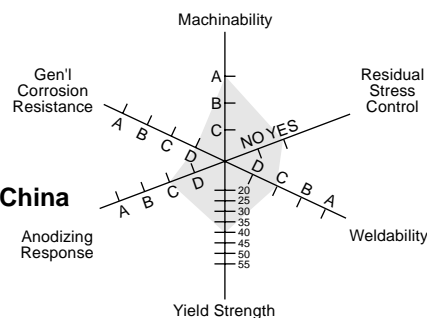
Toolrite 2011®-T3
A-Rated
Machinability
Tool with no chipbreaker 0° rake
4000 rpm, 1046 sfm



Toolrite 2011-T451



Toolrite 2011-T8



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