

# Technotes

## Aluminum Alloy & Temper Selection Guide for Extrusion/Sheet/Plate



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Aluminum is the most abundant metal in the earth's crust, and the third most element after oxygen and silicone. Light weight, highly resistant to corrosion, formidable, recyclable, and low cost, its uses are widespread in many applications.

For all you design engineers, project managers, materials managers, and purchasing professionals looking to match your choice of aluminum alloy and temper to best application, we offer you a condensed version of most common alloys for your consideration. Using your browser, you can hit on a number of resource documents that walk you through hours of content and data. The Aluminum Association, Extruders Council, Wikipedia, and countless thousands of sites are accurate technically, so let's narrow it down to a quick study.

To keep it simple, there are eight series of aluminum alloys (Series 1000 – 8000) utilized in both extrusion and sheet/plate products. Approximately 85% of the alloys and tempers used in industry today are found in Table I below.

Alloy 1100 is primarily used in electrical transmission profiles (wire and bus conductors) due to its high content of aluminum to other alloying agent. Aluminum has about 60% of conductivity, with less than one-third the density of copper resulting in aluminum weighing about half as much as copper. The low cost of aluminum also offers the basis for optimum economic current density as well compared to copper.

Alloy 3003 is a general purpose alloy found more in sheet and plate for architectural, panels systems, coping, and flashing.

Series 5052 alloyed with Magnesium is used in marine applications and products requiring machining, bending, and welding.

And, the "King" of alloys, Series 6000 is utilized in more applications than can be listed, with 6063 the most widely used and versatile alloy due to its surface finish, strength, machinability, formability, weldability, and low production cost. Whether designing for windows, doors, furniture, heatsinks, lighting fixtures, or high rise curtain wall systems, its strength to weight ratio and surface finish provides a great amount of flexibility with this alloy.

If you require a bright finish for picture frames, marine hand rail, shower enclosures, or appliance trim, alloy 6463 is specified. The high copper content gives a better "shine" to buffing or anodized bright-dip finishes.

With structural components such as truck-trailer wall supports, architectural anchor sections, glass hand rail, alloy 6005 or 6061 may be the best choice for strength. Extruders would prefer

you specify 6005 as the mechanical properties are basically the same as 6061, but extrudes faster, therefore, saving you money through increased productivity and extended die life.

Table I below provides a quick reference to chemical properties, and Table II illustrates mechanical properties of these most common alloys, estimated to make up approximately 85% of those most specified.

Table I

Alloy	Silicone (Si)	Iron (Fe)	Copper (Cu)	Manganese (Mn)	Magnesium (Mg)	Chromium (Cr)	Nickel (Ni)	Zinc (Zn)	Titanium (Ti)	Vanadium (V)	Other	Aluminum (Al)
1100	0	0	.05-.2	0.05	0	0	0	0.1	0	0	0.2	99.45
1060	0.25	0.35	0.05	0.03	0.03	0	0	0.05	0.03	0.05	0.03	99.13
3003	0.6	0.7	.05-.2	1.0-1.5	0	0	0	0.1	0	0	0.2	96.7
5052	0.25	0.4	0.1	0.1	2.2-2.8	.15-.35	0	0.1	0	0	0.2	95.7
6005	.6-.9	0.35	0.1	0.1	.4-.6	0.1	0	0.1	0.1	0	0.2	97.45
6061	.4-.8	0.7	.15-.4	0.15	.8-1.2	.04-.35	0	0.25	0.15	0	0.2	95.8
6063	.2-.6	0.35	0.1	0.1	.45-.9	0.1	0.1	0.1	0	0	0.2	97.54
6105	.6-1.0	0.35	0.1	0.15	.45-.8	0.1	0	0	0.1	0	0.2	97.2
6463	.2-.6	0.15	0.2	0.05	.45-.9	0	0	0.05	0	0	0.2	97.85

\*Source: International Alloy Designations & Chemical Composition Limits for Aluminum Alloys. The Aluminum Association Rev 2015.

Table II

Alloy & Temper	Tensile Strength - ksi				Elongation	
	Ultimate		Yield		% Minimum in 2 inch	
	<u>Min</u>	<u>Max</u>	<u>Min</u>	<u>Max</u>	<u>Sample Area</u>	
1100-O	11.0	15.5	3.0	0	25	
3003-H112	14.0	0	5.0	0	0	
6005-T5	38.0	0	35.0	0	8	
6061-T6	38.0	0	35.0	0	10	
6063-T5	21.0	0	15.0	0	8	
6063-T6	30.0	0	25.0	0	10	
6463-T5	22.0	0	16.0	0	8	

\*Source: Aluminum Association Standards & Data 2006

Your choice is driven by the application and processing required through fabrication or finishing. Many variables are considered throughout the initial design stage effecting the overall performance and cost of the final product.

For more detail and best application consultation, give us a call or email, we have a solution for you.