

About Aluminum

A lightweight and economical metal, aluminum is a good conductor of heat and electricity. Depending on the alloy, it can either be heat treated or cold worked to increase its strength, but it will typically not be as strong as steel.

A corrosion-resistant layer forms naturally on its surface, so aluminum offers good corrosion resistance to salt water and chemicals. Clean this layer for improved weldability.

Alloy Comparison

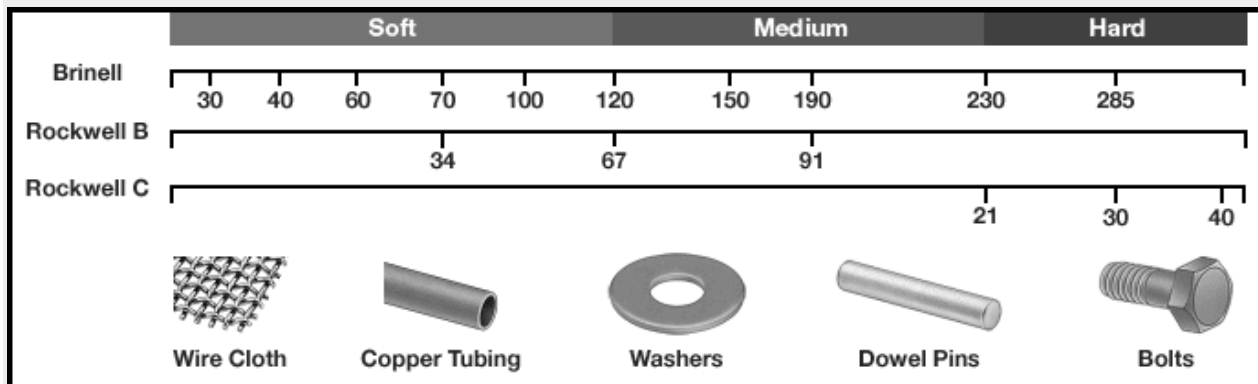
Use the chart below to identify the best aluminum for your application. Circles indicate that a majority of a material's shapes and sizes meet the applicable rating. Yield strength is approximate and may vary by size and shape.

- Excellent
- ◐ Good
- Poor

Aluminum Types	Min. Yield Strength, psi	Hardness, Brinell	Corrosion Resistance	Formability	Machinability	Weldability
Multipurpose						
Multipurpose 6061	35,000	80	◐	◐	◐	◐
Metric 6060	23,000	70	◐	◐	◐	○
Strengthened 6013	50,000	120	◐	○	◐	◐
Machinable Cast MIC6	15,000	65	○	○	◐	○
Architectural 6063	16,000	55	●	◐	◐	◐
Formable 3003	17,000	40	●	◐	○	◐
High Strength						
High Strength 2024	37,000	120	○	◐	◐	◐
Hard 7075	56,000	130	○	○	◐	○
Very High Strength 7050	68,000	—	○	○	◐	○
Mold Quality QC-10	74,000	150	○	○	◐	○
High Strength Marine Grade 5456	33,000	90	●	◐	○	●
Highly Corrosion Resistant						
Highly Corrosion Resistant 5086	17,000	—	●	◐	○	◐
Easy-to-Weld 5052	10,000	60	●	◐	○	◐
Strengthened 5083	28,000	—	●	◐	◐	○
Highly Conductive 6101	28,000	71	●	◐	○	◐
Ultra Corrosion Resistant 1100	2,500	23	●	●	○	◐
Easy-to-Machine						
Very Easy-to-Machine 2011	18,000	80	○	◐	●	○
Strengthened 2017	40,000	105	○	◐	◐	○
Corrosion Resistant 6020	39,000	100	◐	○	●	○

Hardness

As hardness increases, metals become more wear resistant, but they can also be less malleable. The chart below shows hardness measured on different scales.



Temper

Temper indicates the processing done to aluminum alloys for strength and hardness.

Heat Treated (T)—Material has been heat treated for added strength, and it can be heat treated further. These tempers are useful for parts requiring machining, such as fittings and fasteners.

Cold Worked (H)—Material has been cold worked or strain hardened for added strength and cannot be heat treated. Cold-worked aluminum is best for decorative structural components, chemical-processing equipment, and heat exchangers.

Softened (O)—Material has been annealed (heat treated) for softness and bendability and is stress relieved. Use softened aluminum for forming and bending applications that require a very malleable material.

2011 Aluminum

2011 is the most machinable of the commonly available aluminum alloys. Machining this alloy can produce excellent surface finishes on your product, and small, broken chips.

Weldability, strength, and anodizing response are all rated as average at best, and this alloy does not have a high degree of corrosion resistance.

If the ability to make your part quickly is important to you, and strength is not the primary desire, 2011 represents a good choice if you're using aluminum.

2011-T3 Aluminum

Minimum Properties	Ultimate Tensile Strength, psi	55,000
	Yield Strength, psi	43,000
Chemistry	Brinell Hardness	95
	Rockwell Hardness	B60
	Aluminum (Al)	91.2 - 94.6%
	Bismuth (Bi)	0.2 - 0.6%
	Copper (Cu)	5.0 - 6.0%
	Iron (Fe)	0.7% max
	Magnesium (Mg)	2.1 - 2.9%
	Lead (Pb)	0.2 - 0.6%
	Silicon (Si)	0.4% max

2024 Aluminum

Copper is the main alloying ingredient in 2024. It is very strong compared to most aluminum alloys, and has average machinability, but the copper component of this alloy makes it susceptible to corrosion (many items in this alloy are produced with a clad surface to protect the underlying material.) In addition, 2024 is not considered to be weldable.

Finally, the fatigue resistance of 2024 make it a primary choice when the application is expected to be under stress or strain for prolonged periods. It is commonly used in aerospace applications.

2024-T3 Aluminum

Minimum Properties	Ultimate Tensile Strength, psi	70,000
	Yield Strength, psi	50,000
Chemistry	Brinell Hardness	120
	Rockwell Hardness	B75
	Aluminum (Al)	90.7 - 94.7%
	Chromium (Cr)	0.1% max
	Copper (Cu)	3.8 - 4.9%
	Iron (Fe)	0.5% max

Magnesium (Mg)	1.2 - 1.8%
Manganese (Mn)	0.3 - 0.9%
Silicon (Si)	0.5% max

5052 Aluminum

5052 is the alloy most suited to forming operations, with good workability and higher strength than that of the 1100 or 3003 alloys that are commercially available.

5052 is not heat-treatable, but is stronger than most of the 5xxx series of alloys. It has very good corrosion resistance, and can be easily welded. 5052 is not a good choice for extensive machining operations, as it has only a fair machinability rating.

5052-H32 Aluminum

Minimum Properties	Ultimate Tensile Strength, psi	33,000
	Yield Strength, psi	28,000
Chemistry	Brinell Hardness	60
	Aluminum (Al)	95.7 - 97.7%
	Chromium (Cr)	0.15 - 0.35%
	Copper (Cu)	0.1% max
	Iron (Fe)	0.4% max
	Magnesium (Mg)	2.2 - 2.8%
	Manganese (Mn)	0.1% max
	Silicon (Si)	0.25% max

6061 Aluminum

6061 Aluminum is, by most any measure, the most commonly used aluminum alloy. It is specified in most any application due to its strength, heat treatability, comparatively easy machining, and weldability. If that were not enough, it is also capable of being anodized, adding a layer of protection for finished parts.

The main alloy ingredients of 6061 aluminum are magnesium and silicon.

6061-T6 Aluminum

Physical and Mechanical Properties	Ultimate Tensile Strength, psi	45,000
	Yield Strength, psi	40,000
	Brinell Hardness	95
	Rockwell Hardness	B60
Chemistry	Aluminum (Al)	95.8 - 98.6%
	Chromium (Cr)	0.04 - 0.35%
	Copper (Cu)	0.15 - 0.40%
	Iron (Fe)	0.70%
	Magnesium (Mg)	0.8 - 1.2%
	Manganese (Mn)	0.15% max
	Silicon (Si)	0.4 - 0.8%
	Zinc (Zn)	0.25%

6063 Aluminum

6063 is often called architectural aluminum for two reasons - first, it has a surface finish that is far smoother than the other commercially available alloys, and second, its strength is significantly less

(roughly half the strength of 6061), making it suited for applications where strength is not the foremost consideration.

6063 is rated as "Good" for forming and cold working operations, "Excellent" for anodizing, and "Fair" for machining.

6063-T52 Aluminum

Minimum Properties	Ultimate Tensile Strength, psi	27,000
	Yield Strength, psi	21,000
	Brinell Hardness	60
Chemistry	Aluminum (Al)	97.5% max
	Chromium (Cr)	0.1% max
	Copper (Cu)	0.1% max
	Iron (Fe)	0.35% max
	Magnesium (Mg)	0.45 - 0.90%
	Manganese (Mn)	0.1% max
	Silicon (Si)	0.2 - 0.6%

6101 Aluminum

6101 is best suited for applications involving moderate strength and maximum electrical conductivity. It is similar to alloy 6063, but with minor chemistry changes which enhance electrical conductivity. Although slightly lower in conductivity than alloy 1350, it offers greater strength. Its most typical application is bus bar.

6101-T6 Aluminum

Physical and Mechanical Properties	Ultimate Tensile Strength, psi	32,000
	Yield Strength, psi	28,000
	Brinell Hardness	71
	Electrical Conductivity	57% IACS
Chemistry	Aluminum (Al)	97.6%
	Chromium (Cr)	0.03%
	Copper (Cu)	0.10%
	Iron (Fe)	0.50%
	Magnesium (Mg)	0.35 - 0.80%
	Manganese (Mn)	0.03% max
	Silicon (Si)	0.3 - 0.7%
	Boron (Si)	0.06%

6262 Aluminum

6262 was designed as an aluminum alloy for operations where significant machining is required. It contains lead and bismuth to help with chip creation and breakage, as well as to partially lubricate the cutting tool. It is generally regarded as having good strength and corrosion resistance. Finished parts can be produced with a high level of polishing.

6262-T6511 Aluminum

Minimum Properties	Ultimate Tensile Strength, psi	31,900
	Yield Strength, psi	27,600
	Brinell Hardness	71
Chemistry	Aluminum (Al)	94.6 - 97.8%
	Chromium (Cr)	0.04 - 0.14%
	Copper (Cu)	0.15 - 0.40%

Iron (Fe)	0.7% max
Magnesium (Mg)	0.8 - 1.2%
Manganese (Mn)	0.15% Max
Bismuth (Bi)	0.4 - 0.7%
Silicon (Si)	0.4 - 0.8%
Lead (Pb)	0.4 - 0.7%

7075 Aluminum

7075 is the other "aircraft grade" aluminum that is carried by OnlineMetals. Its principal alloying ingredients are zinc and copper, which make it one of the highest-strength aluminum alloys that are available. In fact, its typical strength in the T6 temper is higher than most mild steels.

7075 also has average-to-good ratings for machinability, corrosion resistance, and anodizing response. Like 2024, however, it is not considered to be weldable.

7075-T6 Aluminum

Physical and Mechanical Properties	Ultimate Tensile Strength, 83,000 psi	
	Yield Strength, psi	73,000
	Brinell Hardness	150
	Rockwell Hardness	B87
Chemistry	Aluminum (Al)	87.1 - 91.4%
	Zinc (Zn)	5.1 - 6.1%
		max
	Copper (Cu)	1.2 - 2.0%
	Chromium (Cr)	0.18 - 0.28%
	Iron (Fe)	0.5 max
	Magnesium (Mg)	2.1 - 2.9%
	Manganese (Mn)	0.3% max