

Making the Correct 6000 Series Alloy Selection

The popularity of the 6000 series is due to its versatility. In the USA, they account for the vast majority of aluminum extrusions produced. The 6000 series features magnesium and silicon as its primary alloying elements, which control its strength. Other elements such as iron, copper, manganese, and chromium are added to control or influence finishing response, formability, and toughness.

From a processing and applications standpoint, they are readily available, inexpensive, have good extrudability, excellent mechanical properties, and finish well. They offer corrosion resistance, machinability, weldability, formability, and at least medium strength. They can also be heat and solution treated and artificially aged, up to a T6 temper.

When selecting an alloy it is crucial to consider the actual properties required for the application rather than simply specifying an alloy code and temper. Typically end-users specify 6063 or 6061, it is the task of the alloy supplier, and extruder sales force, to raise end-user knowledge of aluminum and alloys with improved performance.

When properties are specified by the end-user, the extruder can tailor the alloy selection and processing conditions to meet these requirements. This approach allows the extruder to optimize the alloy selection for improved extrudability and surface finish.

Common 6000 Series Alloys

Soft 6000 Series Alloys- As a result of their more diluted alloy content 6060, 6360 and some 6063 type alloys have the highest extrudability and lowest quench sensitivity. Although the strength of these alloys are moderate compared to the medium strength alloys, they are adequate for most architectural applications and suitable for painted and matte anodized finishes.

Alloy 6060- It extrudes well, and is typically used in extrusions with complex cross sections. It anodizes well, has very good corrosion resistance and weldability, plus good cold formability especially in temper T4. Applications include architectural sections for windows, doors, interior fittings, frames, lighting, ladders, fences, heat sinks, electronic modules, truck and trailer flooring, irrigation, heating and cooling pipes, furniture and office equipment.



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Alloy 6360- A high performance alloy suited to extruding complex shapes and multi-hollow profiles which increase design flexibility for applications requiring light walls and tight tolerances. An excellent choice for door framing and window sashes. Due to its lower billet and exit temperature requirements, extrusion speed can be optimized. Furthermore, deterioration in surface quality during production orders is significantly reduced with 6360, allowing runs of far larger orders, gaining in financial benefits.

Alloy 6063- The most commonly used extrusion alloy in the US today, and the least expensive in terms of price per pound. This alloy is highly extrudable, easily machinable (though not the best for extensive machining, as it will gum-up due to its softness) easily fabricated and welded, and relatively strong. It anodizes well, and is a good strata for painting. The 6063 alloys are used in countless applications, including most window, patio door, curtain wall, storefront, skylight architectural applications, many automotive and some aircraft applications, boating, and sporting goods. Alloy 6063 like 6060 is also very well suited for heat sink applications due to, first, its highly extrudable nature, it extrudes the cooling fins well. Secondly, it dissipates heat extremely well.

It can be found in wire, rod, bar, extrusions, structural shapes, tubing, pipe, the list goes on and on. It is the “workhorse” of the industry. It’s not as strong as the more expensive alloys, but strong enough for most uses, and not as corrosion resistant as 6061. Some mills exclusively extrude 6063.

Medium Strength 6000 Series Alloys- The next level in strength is the 6005 alloy family, which includes 6005, 6005A and 6105 in common use. For the medium strength alloys widely used in structural applications, strength combined with toughness and resistance to impact are the main requirements.

Alloy 6005- Is easily extrudable, does not require water quenching, resulting in reduced strength but extremely notch sensitive when air quenched due to the absence of manganese or chromium, which means it does not absorb sufficient energy before fracturing. This can result in poor formability when fabricated, and welding can produce heat zone cracking which may negatively affect 6005’s impact and fatigue resistance.



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Chemistry modifications lead to the development of 6105 alloy, but notch sensitivity still remained. Alloy AA6005A is preferable for medium strength over 6105 and 6005 because of the addition of manganese or chromium which improves its toughness. The structural and machining properties of 6005 alloy are similar to those of 6061.

Alloy 6061- The second most widely used medium strength alloy in North America. It has good mechanical properties, but is more difficult to extrude than the 6005A alloys, therefore it is not suitable for complex cross sections. It displays very good corrosion resistance, and weldability but reduced strength values in the zone of welding. It has medium fatigue strength and good cold formability in the temper T4. It is a good alloy and used in many applications such as heavy duty structures in rail coaches, truck frames, ship building, bridges, military bridges, non-critical aircraft applications, piping, pylons and towers, transportation, aerospace applications, helicopter rotor skins, rivets, and because it is more corrosion resistant than 6063 and close in price it is popular in the marine industry.

Alloy 6013- This is a new medium strength aerospace alloy that provides improved corrosion resistance and formability for use in aerospace applications including primary aircraft structures. Alloy 6013 is an aluminum-magnesium-silicon-copper alloy that has yield strengths 12% higher than alclad 2024-T3 and is virtually immune to exfoliation and stress corrosion cracking. Industry use has demonstrated that 6013 in the T4 condition has better stretch forming characteristics than other aerospace aluminum alloys. Parts can be formed in the T4 condition and aged to the T6 condition without costly heat treating or annealing operations.

Specialty 6000 Series Alloys-

Alloy 6262- This alloy is one of the few aluminum alloys developed specifically for machining applications including screw machine and CNC machine products. Due to its lead and bismuth content, alloy 6262 combines good machinability with high strength, high corrosion resistance and good anodize finishing characteristics, but cold formability is poor. Alloy 6262 is offered in a variety of standard and special tempers.



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In the T6 and T8 condition it offers good to excellent screw machine application. The T9 temper has been used for parts requiring significant machining such as automotive transmission valves, brake pistons and air conditioning applications. Other applications include electrical and cable components, manifolds, hardware and fasteners, and is recommended for applications requiring higher productivity.

Alloy 6262 is one of the most corrosion-resistant aluminum alloys. Susceptibility to stress-corrosion cracking and exfoliation is negligible. (Caution: direct contact by dissimilar metals can cause galvanic corrosion.)

Joining characteristics for welding and brazing of alloy 6262 are significantly improved over alloy 2011, although they are not as good as alloy 6061. Since 6262 is a heat-treatable alloy, strength in its T6 condition can be reduced by heat from welding or brazing. Selection of an appropriate filler alloy will depend on the desired weld characteristics.

Alloy 6463- This alloy was developed for bright anodizing (bright dip) and is primarily used for bright trim and decorative metal work, and competes with traditional trim materials, such as lacquered silver plate, chromium plate and stainless steel. It is a medium strength alloy similar to 6063 in regards to physical properties but slightly more expensive.

Alloy 6082- Is a medium strength alloy, a relatively new alloy with excellent corrosion resistance. It possesses the highest strength values of all the 6000 series alloys, while also providing reasonable extrudability compared to 6061 alloys.

Alloy 6082 is an essential alloy for structural applications and is receiving growing interest by the North American transportation sector after being widely utilized in Europe. In plate form it is commonly used for machining, with its higher strength it is replacing 6061 in many applications. You will find alloy 6082 in high stress applications, trusses, bridges, cranes, ABS pump bodies, bus and truck chassis, and high speed catamaran construction.

Disclaimer: The information in this whitepaper is indicative only and as such is not to be relied upon in place of the full specification. The data provided here has been drawn from various recognized sources, including EN Standards, recognized industry references (printed & online) and manufacturers' data. No guarantee is given that the information is from the latest issue of those sources or about the accuracy of those sources.



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