

A Guide to
**Aluminum
Extrusions**



Extrusion is the process of forcing a heated metal through a die to create a custom cross-sectional profile. While many types of metal can be used in this process, aluminum is a particularly popular choice. Since many types of aluminum alloys can be extruded, it's possible to create components with diverse characteristics.

Depending on the series used, extruded aluminum can be lightweight yet strong, corrosion-resistant, weldable, and much more. In this eBook, we will provide an in-depth look at aluminum extrusion, including the alloys available and their characteristics.



Aluminum Extrusion Techniques

Aluminum can be extruded using two very different processes, known as direct and indirect extrusion.

Direct Aluminum Extrusion

Also referred to as forward extrusion, this technique is the most commonly used. It involves placing a heated billet of aluminum into a heated container while a moving ram pushes the metal through the die. Machinists usually place material blocks between the aluminum and the ram to prevent them from coming into contact with one another. Compared to indirect extrusion, this process requires more force to release the aluminum billet from the extruder.

Indirect Aluminum Extrusion

Indirect aluminum extrusion is also known as backward extrusion. Unlike with direct extrusion, the die in this process remains stationary while the container and heated aluminum move concurrently. Machinists perform this operation using a stem that's longer than the container's length to push the aluminum billet through the die. This method reduces friction on the billet, which also helps to increase the speed of the process.

Aluminum Extrusion Process

The process of extruding aluminum involves 10 basic steps that begin with die preparations and end with secondary operations for surface finishing:

1

Prepare the extrusion die: If there is no existing die available, the first step is to create one. The die must then be heated to 450 °C to 500 °C before the extrusion process can begin.

2

Preheat the aluminum billet: A cylinder of aluminum, called a billet, is then cut and heated until it is malleable but not molten.

3

Move the billet to the extrusion press: Lubricant is added to the extrusion press and the heated billet is then moved into it. A releasing agent is added to the ram to prevent it from joining with the billet during the extrusion process. A hydraulic ram can apply as much as 15,000 tons of pressure. It will press the billet until it fills the container's walls.

4

Press-up extruded material against the die: After the container is full of aluminum with no air pockets, the ram will then continuously press the material through the die.

5

Quench the extrusion: As the extrusion leaves the die, it moves along a run-out table where it cools off using either air or water.

6

Shear the extrusion to the table length: When the extrusion has completed the run-out cycle, it is sheared with a hot saw.

7

Cool to room temperature: Next, the extrusion is moved to a cooling plain to rest until it reaches room temperature.

8

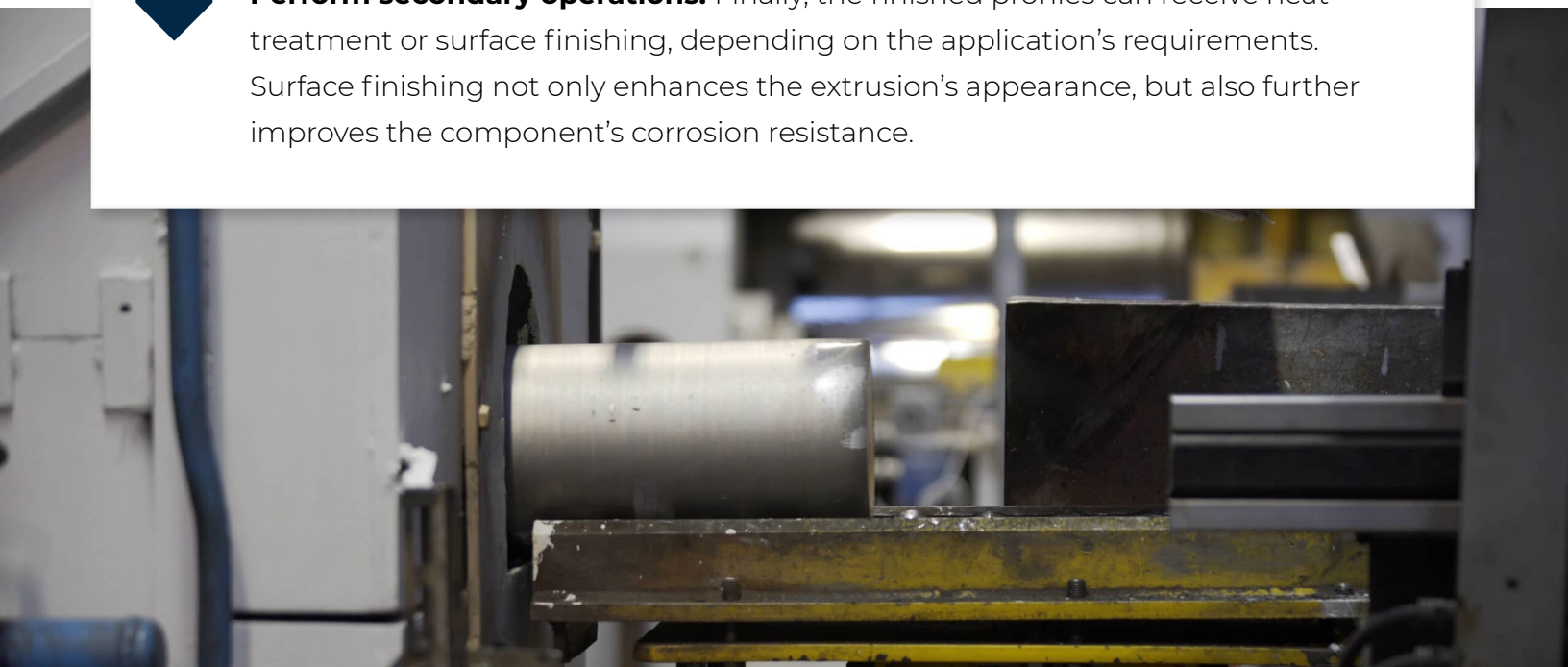
Transfer to a stretcher and stretch into alignment: A stretcher will correct any twists in the extrusion by pulling it into the correct shape. Stretching procedures help ensure that the extrusion adheres to the project's specifications.

9

Cut to length: After straightened and hardened, the extruded profile can be cut into the desired lengths using a saw and then moved to an oven to age.

10

Perform secondary operations: Finally, the finished profiles can receive heat treatment or surface finishing, depending on the application's requirements. Surface finishing not only enhances the extrusion's appearance, but also further improves the component's corrosion resistance.



Benefits of Aluminum Extrusion

Extruded aluminum is a versatile material that can meet a diverse range of structural and aesthetic requirements. Aluminum is highly malleable, but unlike other malleable materials, it is also strong and durable. Aluminum is only one-third the density of steel yet remains stable and strong. Its stability can be further enhanced by alloying it with other metals.

Some of the key benefits of extruded aluminum include:



High Heat
& Electrical
Conductivity



Corrosion
Resistance



Low Weight,
Yet High
Strength



Reduces
Machining
Requirements

In addition, due to aluminum's highly malleable nature, it can be shaped into many complex or detailed design configurations. It can be extruded in solid shapes, semi-solid, or hollow, as well as a wide variety of custom-shaped extrusions. Aluminum extrusions are used to create everything from automotive parts to construction structural supports, door frames, consumer products, electrical connectors, aerospace components, and much more.



Aluminum Extrusion Alloy Types

The extrusion process is suitable for many types of aluminum alloys:

1000 Series: Best for applications that require good formability, weldability, and corrosion resistance. This series is used for general fabrication purposes; however, it offers low strength and does not respond well to heat treatments.

2000 Series: High strength and easily machinable, this series is suitable for parts with complex geometries. It has an excellent strength-to-weight ratio for aerospace applications but offers low weldability and low corrosion resistance.

3000 Series: This series is the most widely used out of all aluminum alloy series. These materials feature manganese, which results in a low to medium strength yet chemically pure material that's well suited to general fabrication as well as chemical and food and beverage applications.

5000 Series: Offering extremely high corrosion resistance, the 5000 series is the ideal choice for marine applications. These materials are easy to weld and form and are fairly low to moderate strength but do not respond well to heat treatments.

6000 Series: Easily weldable, this series can be anodized to create a variety of finishes. It is widely used in structural and architectural settings as well as hardware applications.

PSI Industries produces aluminum extrusions from alloys 6061 and 6063 from the 6000 series:

Alloy 6061: Commonly referred to as structural aluminum, this material offers good weldability, machinability, and tensile strength. It is also corrosion-resistant. 6061 is extruded into diverse components that range from sporting goods to aerospace components.

Alloy 6063: Also known as architectural aluminum, this material is uniquely optimized for extrudability. It can be anodized easily, is suitable for welding, and offers excellent tensile strength. Compared to 6061, it provides greater corrosion resistance and is used in recreational equipment, architectural elements, and furniture.



Aluminum Extrusions From PSI Industries

As a full-service aluminum extruder, PSI Industries creates precision components for a wide array of industries.

From our ISO 9001:2015-certified facility in Texas, we help our clients get their products to market faster and achieve highly precise tolerances. Whether you need to develop a prototype or obtain large quantities, we're ready to meet your needs.

To learn more, [request a quote](#) through our website or give us a call at (972) 712-7900.

About Us

At PSI Industries, Inc., we offer a broad range of manufacturing services to provide high-quality aluminum extrusions. Contact us at 972-712-7900 for more information or request a quote related to your next application.

Contact Us

Corporate Headquarters

1860 Hurd Drive
Irving, Texas 75038

Extrusion Facility

1463 W. Main Street
Olney, Texas 76374

972-712-7900

sales@psiextrusions.com

www.psiextrusions.com

