

# EXTRALUM

## Technical Bulletin.

### Aluminum profiles design.

The whole process of development and production starts at the drawing board. That's where extrusion takes shape and you incorporate different features for a better assembly, minimal finishing work and easier assembly.

To achieve the best design and specifications in an aluminum profile it is important to know and consider the basic design concepts. Creative extrusion design with built-in functions simplifies the next step and reduces costs. This guide presents the most practical recommendations for a good design.

### Aluminum profiles types

There are three types of aluminum profiles

#### **Solid.**

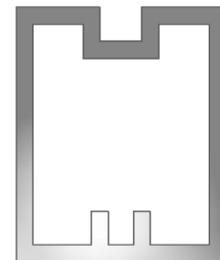
Solids are those whose cross-section do not have any empty space. It is fully circumscribed by metal. In that case, the die is generally made of a steel disc having the opening(s) with the profile shape.



#### **Hollow profiles.**

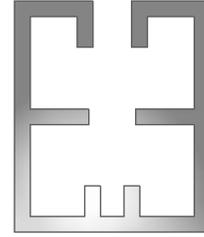
Are those whose cross-section has at least one empty space totally circumscribed by metal. Hollow profiles are made with the use of a die having a fixed mandrel with the internal shape of the profile attached to a steel disc (matrix) with the external shape of the desired profile.

Between the mandrel and the die there is a gap that gives beginning to the hollow extruded profile.



**Semi-hollow profiles.**

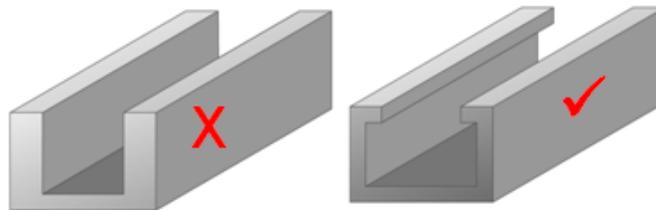
Are those whose cross-section has empty spaces partially circumscribed by metal and obey the opening/area ratio. The necessary matrix for the production of this profile type are generally more complex and fragile.

**Basic principles of design.**

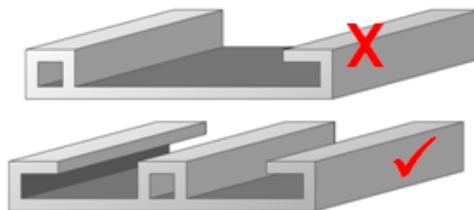
For an optimal aluminum profiles design it is necessary to consider some design guidelines that will help achieve a final product with higher functionality, lower production costs and greater economy.

**Uniform thickness walls.**

The wall uniform thickness on a profile reduces the load on the matrix and, therefore, minimizes the risk of damage. To reduce to the minimum the differences on the surface after the anodizing process, large differences should be avoided in wall thickness within a profile. The uniform wall thickness is obtained by modifying the shape of the extrusion and placing the material where it is most needed.

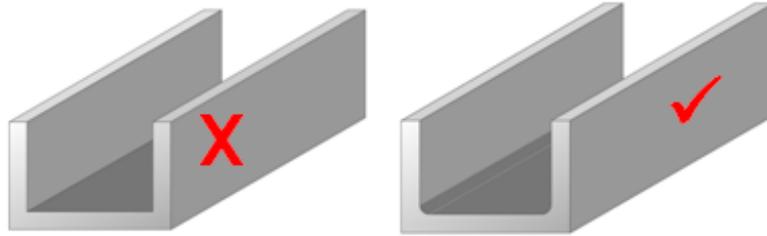
**Symmetry**

With aluminum profiles with symmetrical designs, it is obtained a balanced material flow through the matrix, while the load on it is evenly distributed. In addition, the profile shape is more precise and significantly reduces the risk of breakage of the matrix.



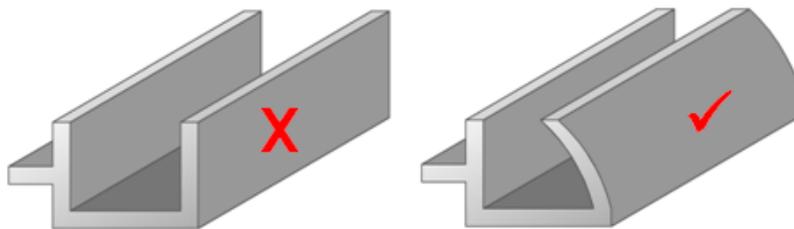
### Radius on angles

As a rule, all angles should be rounded. Normal radius ranging from 0.4mm to 1.0mm. If the design requires more sharp edges or angles, it can be used within at least 0.2mm.



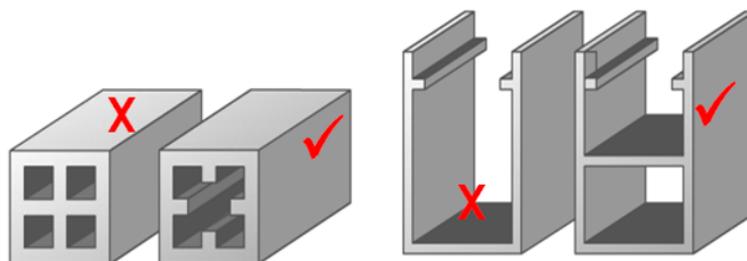
### Diameter of the circumscribed circle

Always try to reduce the circumscribed circle. Besides facilitating the extrusion, it helps to keep low the cost of production and the value of the matrix.



### Simplify and facilitate

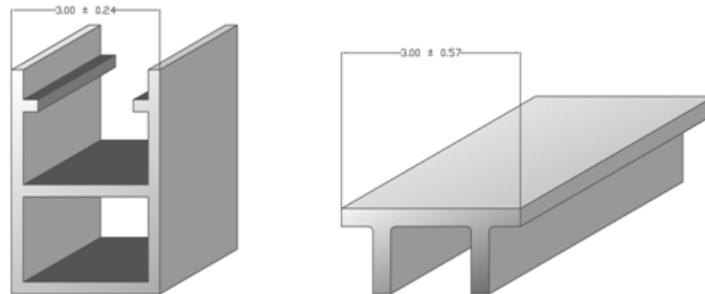
An amendment that has no effect on the functional aspect of the profile but simplifies and facilitates the production will mean lower production costs and a better economy.



Fewer cavities reduces costs.

### Using external dimensions.

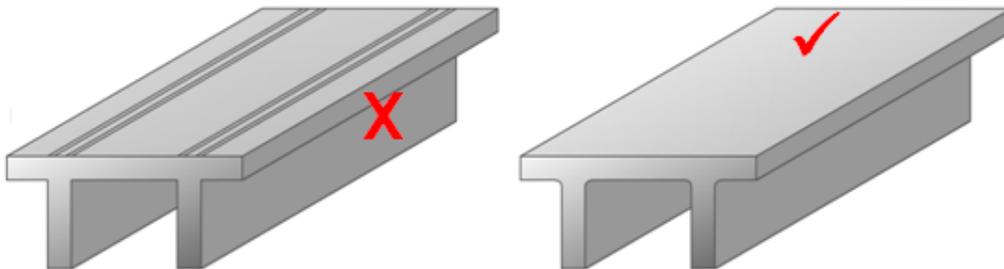
The external dimensions are easier to produce inside tolerance than internal dimensions or angles.



### Considering the final finishing

The exposed surface in the design should always be stated. The narrower the exposed surface is the smoother finish. Abrupt changes in the thickness of the profile could become as marks on the opposite surface of the extrusion, particularly in that section.

The marks on the exposed surfaces can be minimized with a good design.



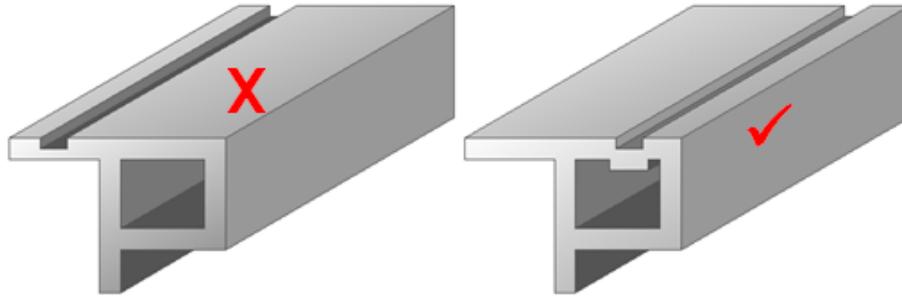
Thus, with straight angular transitions, it could result to be marks on the opposite surface.

Changing shape, rounding the transition sections, reduces the risk of marks on the opposite surface.

### Avoid long, thin details on ends.

If thin details are needed, as channels at the ends, it is recommended:

1. Move the detail near to a support
2. Increase the wall thickness to prevent distortion
3. Provide support at the other end.

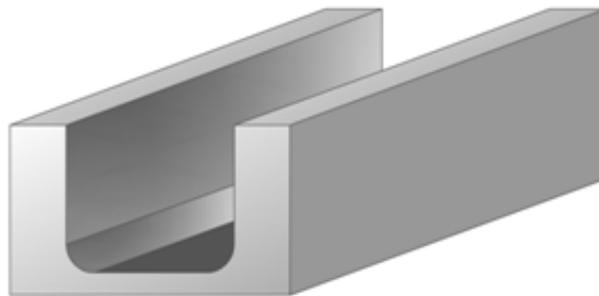


### Wall thickness

Though current trends point to a reduction in costs, it is important to strike a proper balance between cost and functionality of the extrusion. Designing with thicker walls may be more economical. Thin walls are difficult and expensive to extrude.

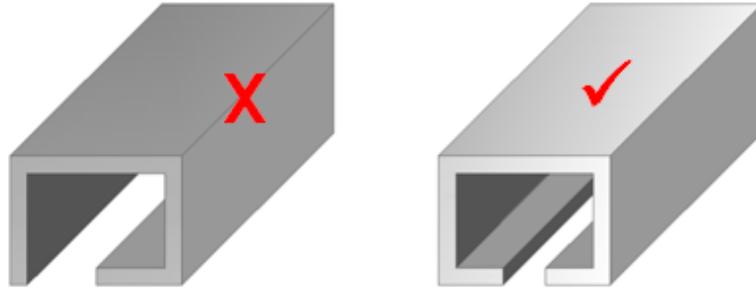
### Thickness transitions.

All thickness transitions must be smoothed using thick radius at intersections between thin wall and thick wall.



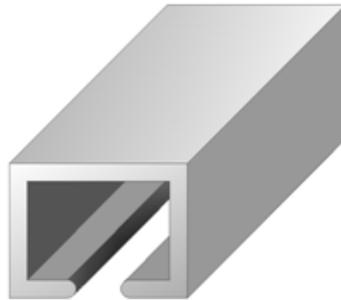
### Semi-hollow areas symmetry.

Maintain symmetry in semi-hollow areas reduces the risk of damage to the matrix.



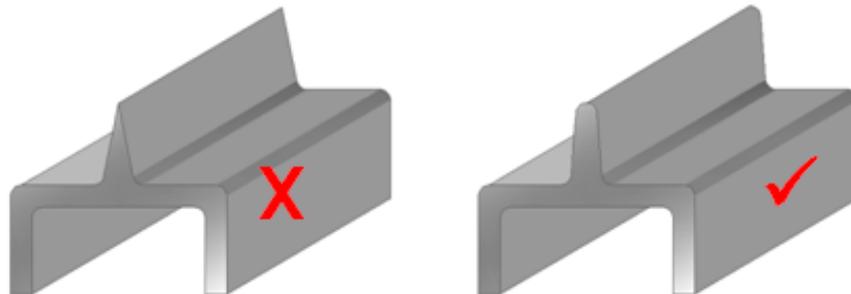
**Semi-hollow smoothed areas.**

Soften the corners of the semi-hollow areas rounding them, brings greater strength and better extrusion performance.



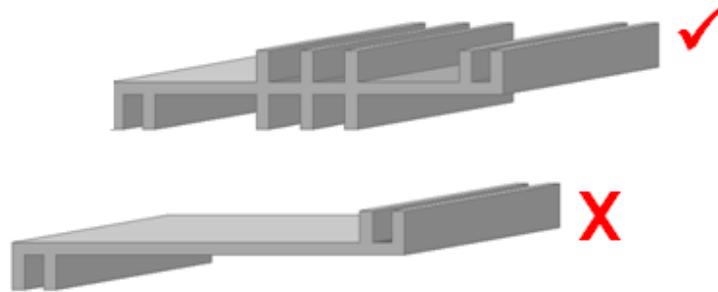
**Avoid sharp edges.**

A sharp border can generate undulation during extrusion. It should be replaced by a flat or rounded edge.



## Reinforcement.

In broad and thin profiles it is advisable to use reinforcements to maintain flatness during extrusion.



Thus promotes a better control of planimetry of the profile

Hollow profiles with deep cavities is advisable to use frames to maintain tolerances and give more strength to the profile. With this you can also reduce the wall thickness.



The reinforcement can control the tolerances and gives greater strength to the profile.

## **Requirements to design new profiles.**

### **Physical sample.**

The sample must come in perfect condition, no dents or deformation, impurities and foreign bodies.

### **Electronic file.**

In **.dwg** or **.dxf** format. If **.pdf** format is used, the dimensions must be legible. The scale used is 1: 1

### **Physical plan.**

Readable levels. 1: 1 scale. All dimensions must be indicated.

### **Units.**

All units must correspond to the International System (SI). All dimensions must be specified in millimeters.

### **Alloy.**

In Extralum the alloys used are the AA6063 and AA6005

### **Temper.**

In Extralum it's used the tempers T4, T5, and M05.

### **Critical dimensions**

Are those dimensions that, in case they require a modification on the profile (for example a change in wall thickness), they must be maintained for reasons of functionality and/or performance. They must be clearly stated in the plan or digital file or, as complementary information, when a physical sample is received.

### **Tolerances.**

The applied tolerances are indicated by the "Aluminum Association" in its manual "Aluminum Standards and Data - 2006." If a different tolerance is required, it must be specified for the respective previous analysis.

### **Wall Thickness.**

The minimum wall thickness used in the extrusion plant is 1.00 millimeter.

In Outsourced Markets, lower thicknesses can be reached.

### **Circumscribed radius.**

The maximum circumscribed radius is:

- 140 mm for solid profiles.
- 110 mm for hollow and semi-hollow profiles.

In Outsourced Markets larger diameters can be reached.

### **Assemblies and accessories.**

Always when the profile is used in a "snap" type assembly or with accessories (screw, pluses, gaskets, etc.), all elements that interact with the profile should be clearly indicated, its description and specifications. This is important to maintain the aesthetics and functionality of the profile and its complements, as a complete unit.

### **Packaging specifications.**

It is extremely important to dispatch the finished product under the conditions that the customer requires. For example, interleaving, plastifying, etc.

### **Quality Inspection methods.**

If you use tools like "pass/fail" or particular checking methods, they should be indicated with a brief description of use and illustrations and / or diagrams.

### **Hardness.**

It should be indicated in Webster, Brinell 500 Kg or Rockwell E.

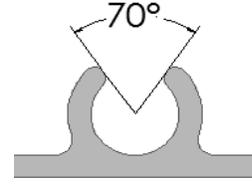
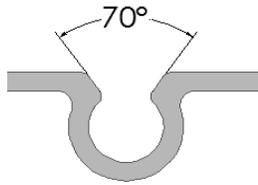
### **Profile length.**

Because of the process conditions, the maximum profile length that can be achieved is:

- 6.4m for anodizing profiles
- 7m for "mill finish" profiles

**Self-tapping.**

Because of machinery restrictions, the self-tapping angle is 70°



The quality of the information provided, determines the time and quality of the designed profile. Good design is associated with lower costs and higher performance.

In any doubt please consult with the Sales Department at Extralum, S.A.