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Tolerances in Aluminum Extrusion

Aluminum extrusion tolerances are applied to the physical dimensions of a part, critical to that part's success. Some dimensions to which tolerances are applied in aluminum extrusions include:

- Flatness
- Straightness
- Twist
- Diameter
- Cross Sections
- Length
- Surface Roughness
- Wall Thickness
- Curved Surfaces

Typical Aluminum Extrusion Tolerances

The tolerance for an extrusion dimension is:

- The diameter of the extrusion die, and
- The function of the size of that particular dimension

Note: You can click on the table to view a larger image.

Dimension A (of a typical fatback extrusion)	+/- Tolerance on Dimension A Diameter of the Extrusion Die	
	Smaller than 10" / 254 mm	Up to 10" / 254 mm
Smaller 0.125" Smaller 3.18 mm	0.014" 0.356 mm	0.006" 0.152 mm
0.125" - 0.249" 3.18 mm - 6.32 mm	0.015" 0.381mm	0.007" 0.178 mm
0.250" - 0.499 6.35 mm – 12.67 mm	0.016" 0.406 mm	0.008" 0.203 mm
0.500" - 0.749" 12.7 mm – 19.02	0.017" 0.432 mm	0.009" 0.229 mm
0.750" - 0.999" 19.05 mm - 25.37 mm	0.018" 0.457 mm	0.01" 0.254 mm
1.000" - 1.499" 25.4 mm - 38.07 mm	0.019" 0.483 mm	0.012" 0.305 mm
1.500" - 1.999" 38.1 mm - 50.77 mm	0.024" 0.610 mm	0.014" 0.356 mm
2.000" - 3.999" 50.8 mm - 101.57 mm	0.034" 0.864 mm	0.024" 0.610 mm
4.000" - 5.999" 101.6 mm - 152.37 mm	0.044" 1.118 mm	0.034" 0.864 mm
6.000" - 7.999" 152.4 mm - 203.17 mm	0.054" 1.372 mm	0.044" 1.118 mm
8.000" - 9.999" 203.2 mm - 253.97 mm	0.064" 1.626 mm	0.054" 1.372 mm
10.000" - 11.999" 254 mm - 304.77 mm	0.074" 1.880 mm	
12.000" - 13.999" 304.8 mm - 355.57 mm	0.084" 2.134 mm	
14.000" - 15.999" 355.6 mm - 406.37 mm	0.094" 2.388 mm	
16.000" - 17.999" 406.4 mm - 457.17 mm	0.104" 2.642 mm	
18.000" - 19.999" 457.2 mm – 507.97 mm	0.114" 2.896 mm	

Note: Numbers rounded off to nearest decimal.

Standard Aluminum Extrusion Tolerances

Noted here are:

1. **Flatness**
2. **Squareness**
3. **Straightness Along the Length of the Extrusion**
4. **Twists Along the Length of the Extrusion**
5. **Flatness and Surface Roughness**

Flatness

This tolerance applies to any one inch along the surface of the profile or tolerance, multiplied by the extrusions width along the gradual deviation from 'flat'. Note that flatness is checked by using a feeler gauges and a straight edge.

For Hollow Profiles:

Note: You can click on the table to view a larger image.

Wall Thickness	Surface Width of up to 5.999 inches (152.4 mm)	Surface Width of 6.000 - 7.999 inches (152.4 mm – 203.2 mm)	Surface Width of 8.000 to 9.999 inches (203.2 mm – 254.0 mm)
Of up to 0.124" Of up to 3.15 mm	0.006" 0.152 mm	0.008" 0.203 mm	0.012" 0.305 mm
0.125" - 0.187" 3.18 mm – 4.75 mm	0.006" 0.152 mm	0.008" 0.203 mm	0.010" 0.254 mm
0.188" - 0.249" 4.78 mm – 6.32 mm	0.004" 0.101 mm	0.006" 0.152 mm	0.010" 0.254 mm
0.250" - 0.347" 6.35 mm - 8.81 mm	0.004" 0.101 mm	0.006" 0.152 mm	0.008" 0.203 mm
0.375" - 0.499" 9.53 mm - 12.67 mm	0.004" 0.101 mm	0.006" 0.152 mm	0.008" 0.203 mm
0.500" - 0.749" 12.7 mm - 19.02mm	0.004" 0.101 mm	0.004" 0.101 mm	0.006" 0.152 mm
0.750" - 0.999" 19.05 mm - 25.37	0.004" 0.101 mm	0.004" 0.101 mm	0.006" 0.152 mm
1.000" and up 25.4 mm and up	0.004" 0.101 mm	0.004" 0.101 mm	0.004" 0.101 mm

Note: Numbers rounded off to nearest decimal.

For Solid, Bars and Semi-Hollow Profiles:

Note: You can click on the table to view a larger image.

Wall Thickness	Surface Width of up to 5.999 inches (152.37 mm)	Surface Width of 6.000 - 7.999 inches (152.4 mm - 203.17 mm)	Surface Width of 8.000 to 9.999 inches (203.2 mm - 253.97 mm)
Of up to 0.124" Of up to 3.150 mm	0.004" 0.102 mm	0.006" 0.152 mm	0.010" 0.254 mm
0.125" - 0.187" 3.175 mm - 4.750 mm	0.004" 0.102 mm	0.006" 0.152 mm	0.008" 0.203 mm
0.188" - 0.249" 4.775 mm - 6.325 mm	0.004" 0.102 mm	0.006" 0.152 mm	0.008" 0.203 mm
0.250" - 0.347" 6.35 mm - 8.814 mm	0.004" 0.102 mm	0.006" 0.152 mm	0.006" 0.152 mm
0.375" - 0.499" 9.525 mm - 12.675 mm	0.004" 0.102 mm	0.004" 0.102 mm	0.006" 0.152 mm
0.500" - 0.794" 12.7 mm - 19.025 mm	0.004" 0.102 mm	0.004" 0.102 mm	0.006" 0.152 mm
0.750" - 0.999" 19.05 mm - 25.375 mm	0.004" 0.102 mm	0.004" 0.102 mm	0.006" 0.152 mm
1.000" - 1.499" 25.4 mm - 38.075 mm	0.004" 0.102 mm	0.004" 0.102 mm	0.006" 0.152 mm
1.500" - 1.999" 38.1 mm - 50.775 mm	0.004" 0.102 mm	0.004" 0.102 mm	0.004" 0.102 mm
2.000" and up 50.8 mm and up	0.004" 0.102 mm	0.004" 0.102 mm	0.004" 0.102 mm

Note: Numbers rounded off to nearest decimal.

Squareness

Squareness is checked by making use of a protractor, or a feeler or square gauge. The standard allowable when it comes to squareness is +/- 1° from the specified angle of the profile.

For example, if a part is 45°, ChinaSavvy is allowed up to 46° up and a 44° down. Here, 1° equals 0.017" per inch. For example, if a part has a leg with a 4 inch height, ChinaSavvy is allowed a total of 0.068" from the tip of the leg.

Straightness Along the Length of the Extrusion

Straightness is checked by making placing the extruded part on the granite block or any straight edge. The amount of bow is measured using feeler gauges.

The standard allowable tolerance here is 0.012" per foot. For example, when a part is six feet long, a bow of 0.072" over the entire length is allowable.

Twists Along the Length of the Extrusion

Twists are checked by placing the extruded part onto a granite block or a flat surface. One corner is held down and the amount of rise on the opposite, diagonal corner is then measured by making use of a feeler gauge.

Note: You can click on the table to view a larger image.

Part Width	Standard Allowable
Up to 1.499" **Up to 38.1 mm**	1° per Foot To a Maximum of 7°
1.500" - 2.999" **38.1 mm - 76.2 mm**	1/2° per Foot To a Maximum of 5°
3.000" and up **76.2 mm and up**	1/4° per Foot To a Maximum of 3°

Note: Numbers rounded off to nearest decimal.

Some guidelines to apply to the above mentioned tolerances:

Note: You can click on the table to view a larger image.

1/4° over 1" (25.4mm) = 0.0045" (0.11 mm)	1/4° to a maximum of 3° = Maximum Length 12 Feet / 3.7 Meters
1/2° over 1" (25.4mm) = 0.0085" (0.2 mm)	1/2° to a maximum of 5° = Maximum Length 10 Feet / 3.0 Meters
1° over 1" (25.4mm) = 0.017" (0.4 mm)	1° to a maximum of 7° = Maximum Length 7 Feet / 2.1 Meters

Note: Numbers rounded off to nearest decimal.

Flatness and Surface Roughness

These tolerances become useful in heat sink applications and are typically as follows:

Note: You can click on the table to view a larger image.

The Aluminum Surface	The Flatness in inches / milimeters	The Surface Roughness (RMS)
Machined	0.001" 0.03 mm	64 or better
As Extruded	0.004"and up to 0.006" 0.10 mm and up to 0.15 mm	125 - 64
Sanded (excluding edge rounding)	0.002" / 0.003" 0.05 mm / 0.08 mm	64 - 32

Note: Numbers rounded off to nearest decimal.

Non-Standard Mechanical Aluminum Extrusion Tolerances

Loose and close dimensional tolerances that are relative to the industry's standards can also be specified in cases where it is called for to meet requirements.

For tighter mechanical tolerances, ChinaSavvy is capable of making the needed modifications to the extrusion die. Modifications however will lead to a slower extrusion rate, increased inspections and, in some cases, a higher cost and a higher extrusion rejection rate.

We are also capable of suggesting die design changes, which will help to achieve fit, functional and form requirements set out by our clients.

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Further Suggested Reading:

- **Aluminum Grades Used in Extrusion including Chinese Equivalents**
- **Finishes that can be used on Aluminum Extrusions**
- **Assembling Aluminum Parts**