CREATING CUSTOM PROFILES

During the design phase there are still many things to consider when dealing with extruded heat sinks. This includes, but is not limited to extrusion considerations such as, cost, tolerances, extrudability, manufacturing considerations and heat sink design.

For all new extrusion designs an extrusion die needs to be made. Depending upon the complexity and shape of the profile being extruded, die costs can range from $1000 to $20,000. Extrusion dies are designed for specific presses, are proprietary and are not transferable.

Extrusions typically follow the Aluminum Association Tolerances. This specifies the tolerances that can be held at the various widths, heights and aspect ratios of an extrusion. These tolerances can and do change at various points of the extrusion depending on location relative to the base of the extrusion, etc. Tightening these tolerances can be done at additional cost. Flatness tolerances range from .004 in/in of to .012 in/in of width. These tolerances do not apply to one inch increments. This can be corrected a machining operation. The mounting area can be machined flat to tolerances as tight as .001" T.I.R and a surface roughness of 20 micro-inches.

We can currently extrude shapes up to a 21" circle size with a 6:1 ratio. On smaller circle sizes greater ratios, up to 16:1 up to 12" circle size, can be held. However, technology is always advancing so please do not hesitate to ask about larger sizes. All extrusion mills have minimum pounds per order requirements. Our extrusion mill typically has a minimum order requirement that can vary between 500 pounds to 4,000 pounds depending on the circle size of the extrusion.

MANUFACTURING CONSIDERATIONS - HEAT SINK DESIGN

Very few restrictions apply when either drilling or boring holes into heat sinks. Nonetheless, some items in the overall heat sink design must be considered.

1. For small holes, those under .125" in diameter, depth must be considered due to the ability to acquire tooling capable of drilling beyond standard depths. Also drills that intersect fins off center run the risk of being out of round or breaking the tooling. (Fig. 1)

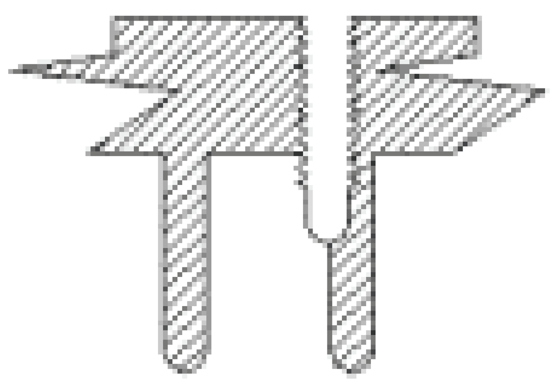


Fig .1

2. Tapping a hole through the heat sink, without intersecting any part of a fin, is the easiest and most trouble free tapping process. (Fig 2)

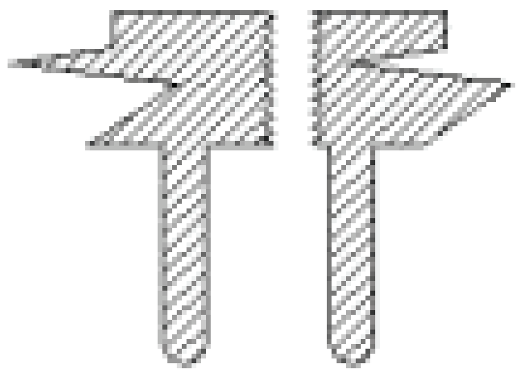


Fig. 2

Tapping that intersects a fin off center run the same risks as drilling into a fin off center. Additionally, this may cause the tap to alter the threads of the hole. This type of tapping also proves difficult to deburr and clean. (Fig. 3)

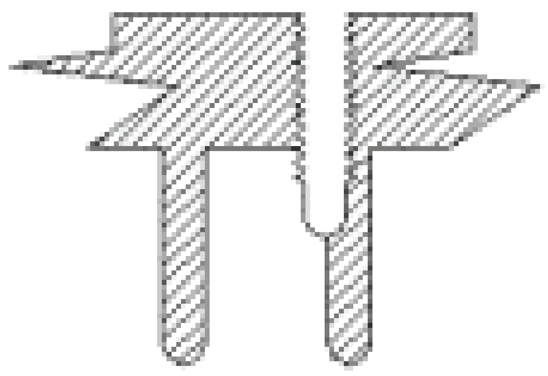


Fig. 3

A tapped hole that does not pass through the heatsink base (blind hole) provides several challenges too. Creating a blind hole requires that the hole be drilled deeper than the depth of the threads. As a general rule, the hole must be drilled deeper than the threads by at least twice the diameter of the tap. (Fig 4.)

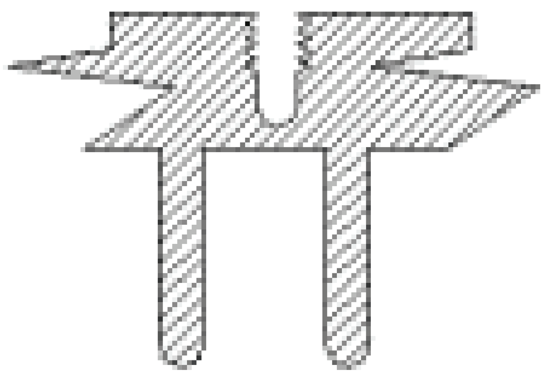


Fig. 4

3. Deburring is a process in which burs are removed from the material. Deburring must be done after the cutting operation and drilling, drilling/tapping or punching operations. The deburring process after cutting is performed using a wire wheel to remove all burs. This will leave a surface free of burs but with a slightly rough surface around the edges. Deburring after drilling, drilling/tapping or punching is done using powered hand tools. Deburring holes that have an off center intersection with a fin, or when clearance between fins is minimal, must be done by using small hand files. An example of difficult, more costly deburring is shown in Fig 5.

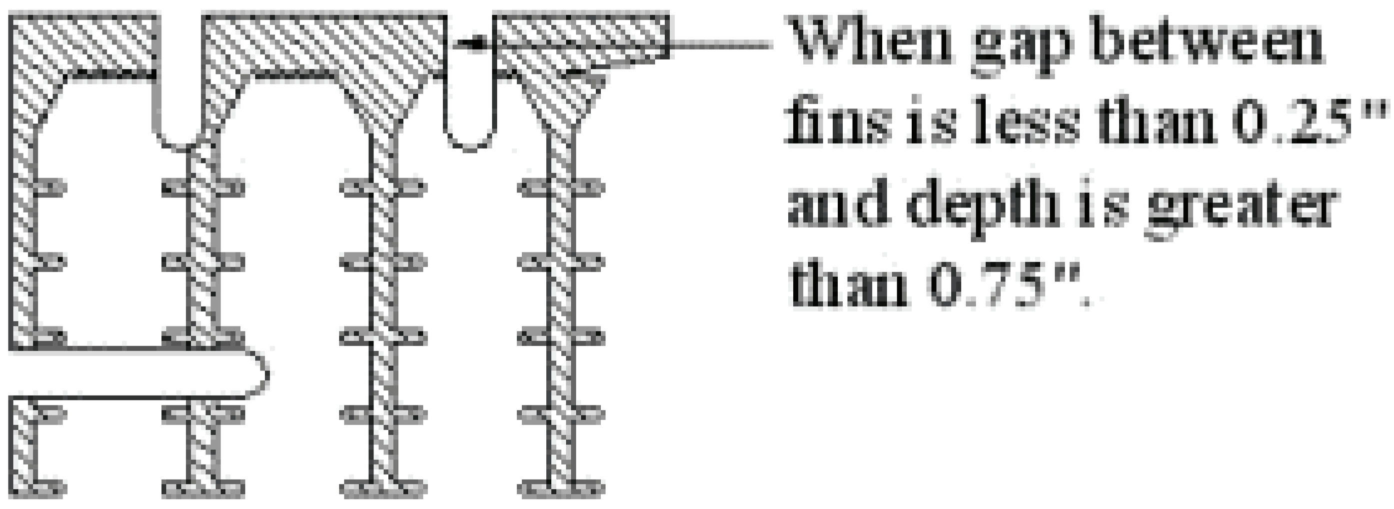
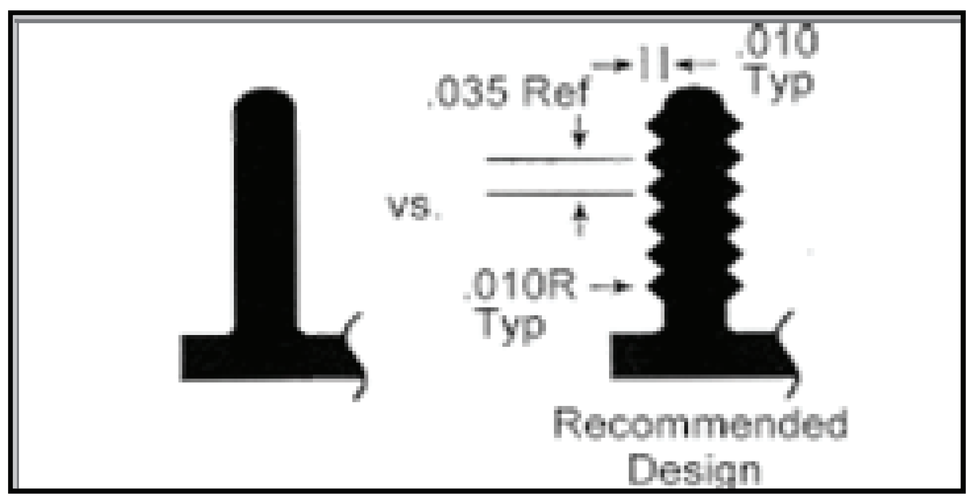


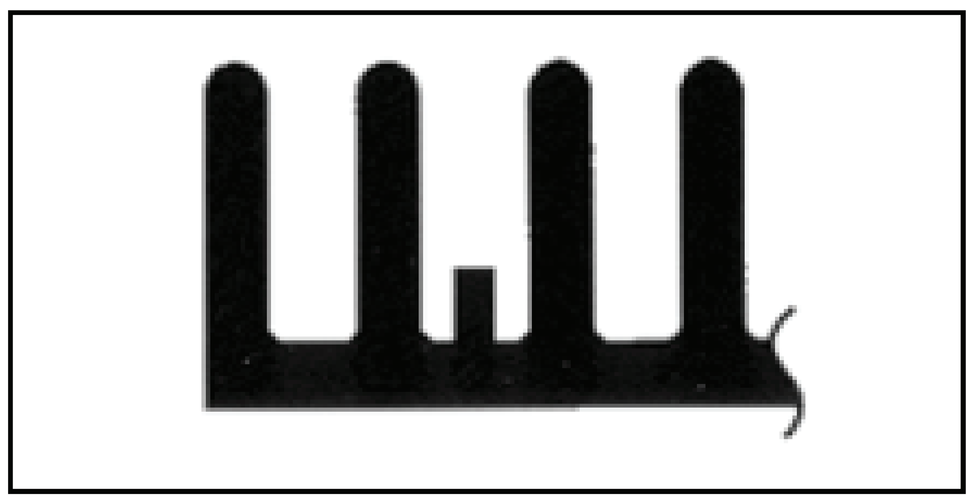
Fig. 5

4. Surfacing is a process in which we utilize our CNC machines to remove material from the surface of an extrusion to provide a smooth, flat finish. These finishes are typically 64 micro inches or better and flat to 0.001” T.I.R. We can single pass surface finish for parts under five inches. Items requiring a finish area larger than five inches will require multiple passes of a cutter. For these items, a secondary finishing operation is needed to improve the overall appearance; this generally improves the surface finish. Multiple passes do NOT degrade the overall flatness. The differences between multiple passes have been measured at 0.0002” – 0.0004”.

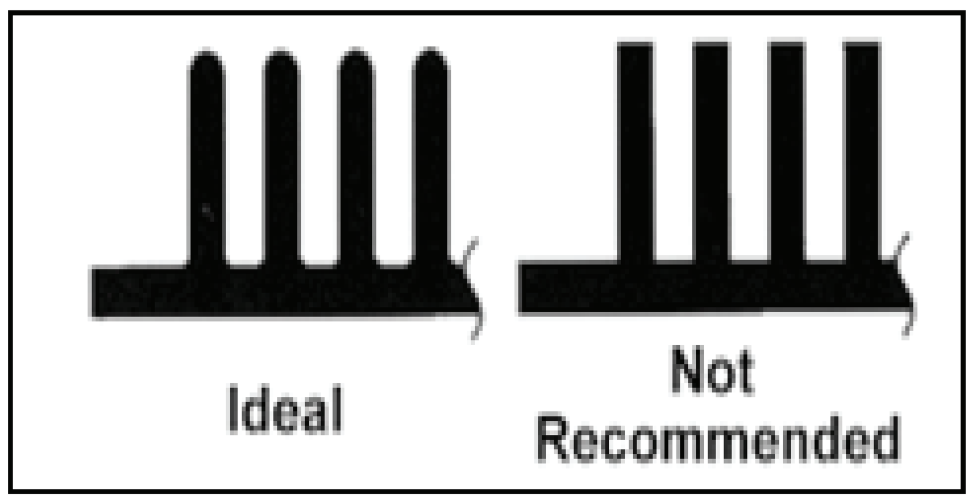
5. Here are some other design considerations:



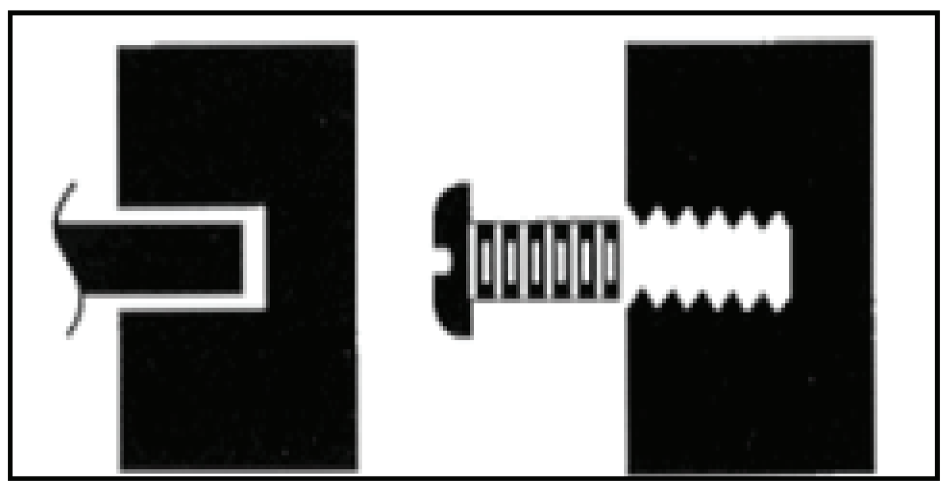
Consider fin serrations for extra surface area



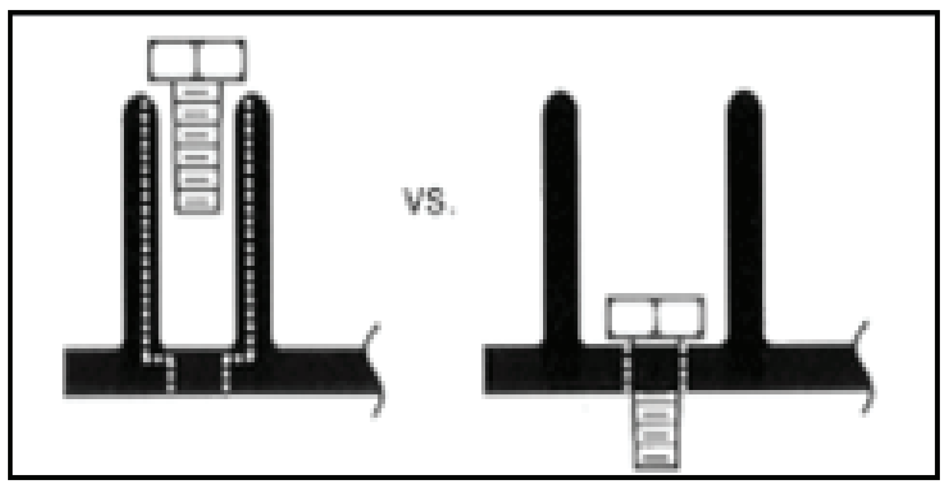
Avoid larger masses surrounding smaller ones (these won't fill)



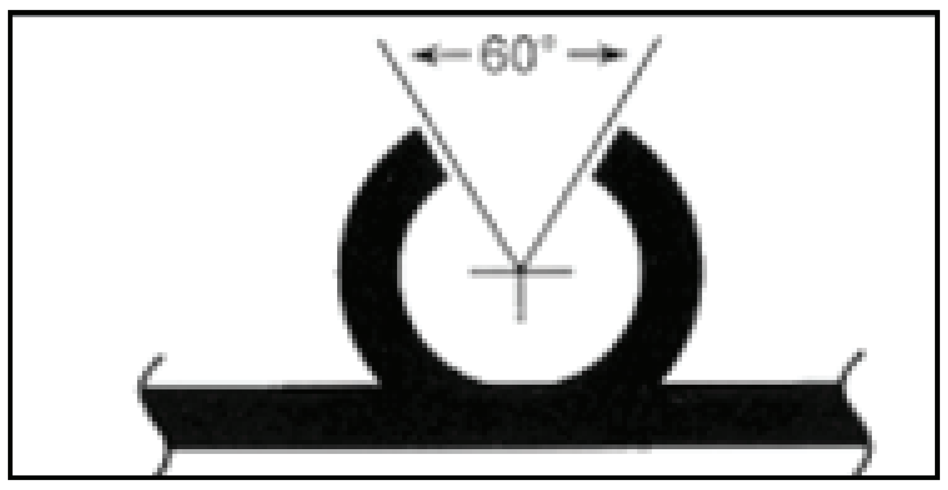
Consider a radius on fins and bases for easier extrusion



Use serrated extruded slots for threaded hardware
and straight slots for PC boards to save machining



Design the extrusion with clearances to allow for tools and hardware



Use a 60º opening for screw bosses to improve extrudability