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Micro-forged Aluminum Heat Sinks and Spreaders Frequently asked Questions

What is micro-forging? Often described as precision forging this high temperature shaping process uses tons of pressure to form metal “slugs” into given tooling shapes. The resulting near-net shaped parts resemble impact extrusions but with more consistent metallic grain structure. This internal structure increases strength and thermal heat flow characteristics.

What sizes are available? The typical micro-forged heat sink has one flat side used as a heat spreader for component mounting. The opposite side has extended surface fins used for cooling. This typical configuration can be modified based on the tooling configuration and complexity. Base areas of up to 25 square inches are common with larger sizes dictated by the capacity of the forging press. Maximum fin height and density are based on a fin height vs. between fin air gap of ~30:1. This high a ratio is not available in die cast parts. Minimum fin thicknesses of 1 mm (0.040 inches) or less are possible. A variety of fin shapes (round, elliptical, square and rectangular) are also available.

What materials are used? Aluminum micro-forgings use the same 6063 alloy (T5 temper) as a linear extrusion. This material provides a thermal conductivity of approx. 200 W/mK with excellent thermal contact between the fins and the base. Good micro-forging practices will yield excellent grain structure in this critical region resulting in increased heat flow and close to ingot yield strengths.

What are the advantages over linear extrusion? Micro-forging allows near net shape parts (little machining to create an as-used part) with details in three dimensions. Linear extrusions only provide control of two dimensions. Substantial machining is required for end use.

What are the advantages over die-casting? There are many advantages but the two primary ones are the lower cost of tooling and the alloys that can be used. Tooling cost for a typical one-cavity die cast tool is between 4 and 8 times more expensive than micro-forged tools. Also, for thermal applications die cast parts use heavily alloyed aluminum with conductivities at 30 to 50% of the 6063 alloy used in micro-forged parts. The silicone alloying agent in die cast aluminum increases the ability to remove the part from the mold but severely reduces the heat removal characteristics.

What is the piece part price comparison? As a finished, ready to install part a micro forged part is typically slightly (10% - 20%) more expensive than a conventional aluminum extrusion of the same volume. In comparison to die cast parts, micro forged parts are substantially more expensive (40% - 50%). However, this cost is heavily dependent on the quantity of parts being made. Tooling, on-going maintenance and other costs of the die casting process may make the micro-forged parts more equally priced.

If you have more specific questions regarding micro forged parts please email to info@thermshield.com.