



## Fin Workmanship Guidelines

Definitions and standard tolerances if no other specifications are given in documentation.

### All Fin

- a) **Camber** – Variation in the cut off dimension as measured from 1 side to the other (should be less than the cut off tolerance)
- b) **Square** – the total fin run out measured with a square
  - If less than 15 fpi or less than 6” flow length square should be less than 1 fin
  - If greater than 15 fpi or greater than 12” flow length square should be less than 2 fin
  - When looking at the fin the part should not look out of square
- c) **Lean** – the top of the fin is in front or behind the bottom of the fin (the fin leg should appear vertical)
- d) **Curl** – the fin wraps itself into a cylinder shape (the fin should lay flat under minimal load)
- e) **Potato chip** – twist in the fin (fin should lay flat under minimal load)
- f) **Scratches/dents/imperfections** – should not be able to catch your fingernail in any blemish
- g) **Foreign Objects** - fin will be free of any visible loose debris.
- h) **Burr on edge of parts** – any burr on edge of parts should not affect the fin height measured at the edge of part
- i) **Snake** – Flow length swerves back and forth during the fin forming process. For every 1” of wave pitch (snaking) a maximum of 0.020” for the amplitude of the wave (snake).
- j) **Bend Radius** – ID bend radius must be one material thickness minimum to avoid cracking material
- k) **Spring Back** – Fin is folded at 90°. The angle between vertical fin legs is dependent on the material being folded. This dimension will be considered reference only and will not be measured or accounted for.
- l) **Fins Per Inch** – Industry standard tolerance for fins per inch is 2 to 4 fins per inch +/-0.25 fin. 5 to 19 fins per inch +/-0.5 fin. 20 to 49 fins per inch +/-1 fin. 50 fins per inch and above, the fins per inch tolerance is reference to the nearest whole number of fins in the part to meet the requested cutoff dimension.

### Lance Fin

- a) **Lance Burr** – the amount of burr in the lance openings (should be less than (2\*mtl. Thk.) with a maximum of 1 closed lance for every 3 inches of fin). Lance opening must take into account material spring back. Therefore, the calculation is  $(1/\text{fins per inch} - 2 \times \text{material thickness}) / 2 - 1 \times \text{material thickness} = \text{lance opening}$ .

### Plain Fin

- a) **Length of Flat** – the minimum amount of flat surface in one fin top ( $\approx 1/\text{FPI} - 4 \times \text{Mtl.}$ )
- b) **Doghouse** – the distance between the high side of the flat on the fin bottom and the table (should be able to squeeze by hand between two flat plates and reduce to a gap that is equal to or less than one material thickness)
- c) **Whip** – the amount of bow in the leg off of vertical (should be less than  $0.010 \times \text{yield strength of material being formed} / 5,000$  per one inch of fin height when measured against a straight edge)

### Wavy Fin

- a) **Peak to Valley** – the variation in the height as measured from the peak of the wave to the next valley (should be predominately less than 0.002”, however not greater than the total height tolerance)



## Robinson Fin Machines

- b) **Wrinkle in fin leg** – may occur in some ruffle fin
- c) **Dimensions of wave pitch, amplitude and radius** – can be measured on the tooling only.

### Foot Cuts

- a) **Cut quality** – cut should be parallel to the fin flow watch for hairs or damage to the bottom of the fin present. Overall cutoff size to be set to  $\pm 0.020$ ” at production. Cutoff dimension is a reference at customer due to fins ability to shrink or expand during shipping.
- b) **Foot Flatness** – foot must not stick above fin ht. (if foot is tall roll down with approximately 1” pipe or rolling height calibration)
- c) **Hook Foot** – standard tolerance for hook foot height if not specified on print is  $\pm 0.030$ ”
  - 1) Radial fin – the fin count is given including hooks which are maximum hooks
  - 2) Standard fin – cut off is the total fin count plus hooks (if the hook is less than or equal to half the height of the fin and there is zero tolerance on the number of fins in the part)
  - 3) Standard fin - if the fin count is allowed to vary, the cut off is cut with hooks so that it meets the required fpi at the specified cut off dimension
- d) **Full Foot and No Foot** – (measurement includes one vertical fin leg) standard tolerance for this cut is  $\pm 0.030$ ”.
  - 1) Full foot size is:  $\text{Fin Top} - \text{Mtl Thk} - 0.030 = \text{Full foot size} \pm 0.030$
  - 2) No foot size is:  $\text{Mtl Thk} + 0.030 = \text{No foot size} \pm 0.030$

### EDM Burns

- a) **Recast** - a burn that leaves extra material / graphite around the edges of the cut / hole. Recast must be less than 2 material thicknesses.
- b) **Coarseness** - a burn that leaves rough edges around the cut / hole. Coarseness must be less than 0.020 inches.
- c) **Jaggedness** - a burn that changes dimensions as it burns through the configuration of the fin. Jaggedness must be less the 0.020 inches.