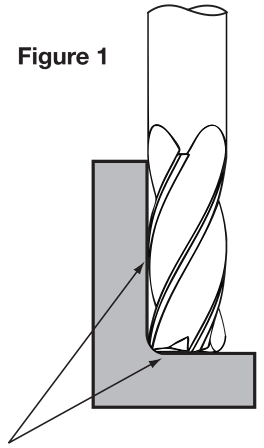
Part Finish Reference Guide

Finishing cuts are used to complete a part, achieving its final dimensions within tolerance and its required surface finish. Most often an aesthetic demand and frequently a print specification, surface finish can lead to a scrapped part if requirements are not met. Meeting finish requirements in-machine has become a major point of improvement in manufacturing, as avoiding hand-finishing can significantly reduce costs and cycle times.

Common Finishing Problems

- Burrs
- Scallop marks
- Chatter marks

Figure 1



Factors That Influence Part Finish

- Specific material and hardness
- Cutting tool speeds & feeds
- Tool design and deployment
- Tool projection and deflection
- Final pass depth of cut
- Tool-to-workpiece orientation
- Rigidity of workholding
- Coolant and lubricity
- Amount of material remaining for finishing operations

Solutions to Common Finishing Problems

- Tools with high helix angles and flute counts work best for finishing operations. Softer materials show great results with higher helices, while harder materials can benefit greatly from increased flute counts.
- Increase your RPM or lower your IPT **(Figure 2)**.
- Use tools with corner radii.
- Ensure that tool runout is extremely minimal.
- Use precision tool holders that are in good condition, are undamaged, and run true.
- Opt for a climb milling machining method.
- Use tooling with Variable Pitch geometry to help reduce chatter.
- A proper radial depth of cut (RDOC) should be used. For finishing operations, the RDOC should be between 2 and 5 percent of the tool's Cutter Diameter.
- For deepwalls, use reduced neck tooling to help to minimize deflection **(Figure 3)**.
- Extreme contact finishing (3x cutter diameter), may require a 50% feed rate reduction.

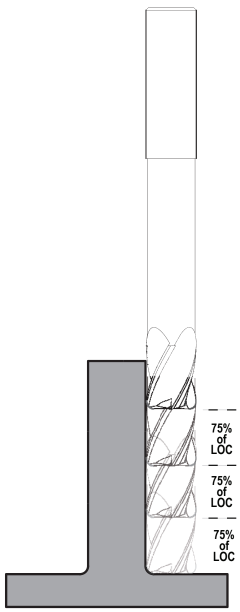


Figure 3

Figure 2: Quick Reference

To improve surface finish	↑ Increase RPM	↓ Lower IPT	Climb Mill

Common Surface Finish Nomenclature (Figure 4)

R_a = Roughness average
R_q = RMS (Root Mean Square) = $R_a \times 1.1$
R_z = Ra x 3.1

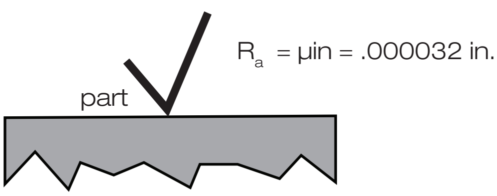


Figure 4

Helical