| Problem | Possible Cause | Possible Solution |
|---|---|---|
| Excessive Flank Wear | Speed too high | Reduce the cutting speed RPM's (n). |
| | Improper feed speed (too slow) | Increase feed per tooth (fz). |
| | Hard workpiece material >55 Rc | Try 90-100 SFM (vc) with multi-fluted tool (5 flutes+). |
| | Recutting chips | Change feed speed to change chip size or clear chips with coolant or air pressure. |
| | Milling strategy | Ensure you are climb milling unless workpiece material has hard/abrasive outer skin or high impact tool steel like D2, then conventional milling technique is preferred for breakthrough. |
| | Improper cutting angle | Change to correct cutting angle, tilt tool at 15 degrees. |
| | Too low a primary relief angle | Change to larger relief angle. |
| Excessive Corner Wear | No corner radius | Implementing corner radius on tool adds strength and increases tool life. |
| | Speed too high | Reduce the cutting speed RPM's (n). |
| | Tool runout | Check tool runout in holder/spindle. <.0003" (.0076mm) desired. Hand ground flats can be suspect and common cause. Use collet, milling chuck, or shrink fit holders if possible. |
| | Tool overhang | Ensure you are using shortest OAL possible, stub tool in holder. Utilize stronger necked tool for longer reaches. |
| Cutting Edge Chipping | Lack of rigidity (tool) | Use shortest end mill available, hold shank deeper in holder, investigate for tool slippage. Use short gage length holder. |
| | Lack of rigidity (workpiece) | Tighten workpiece fixture - a common problem. |
| | Feed too high | Decrease feed per tooth (fz). |
| | Feed too high on first pass | Decrease feed per tooth (fz) on first pass through workpiece skin or reduce radial width of cut (ae) first pass. |
| | Part entry | Reduce FPT on entry - implement radius in or sweeping entrances - avoid 90° (perpendicular) entry. |
| | Milling strategy | Ensure you are climb milling unless workpiece material has hard/abrasive outer skin or high impact tool steel like D2, then conventional milling technique is preferred for breakthrough. |
| | Tool overhang | Ensure you are using shortest OAL possible, stub tool in holder. Utilize stronger necked tool for longer reaches. |
| | Tool runout | Check tool runout in holder/spindle, <.0003" (.0076mm) desired. Hand ground flats can be suspect and common cause. Use collet, milling chuck, or shrink fit holders if possible. |
| | Not enough rigidity of machine tool & holder | Change rigid machine tool or holder. |
| | Cutting edge prep | Ensure tool has proper edge prep for workpiece material. |
| | Teeth too sharp | Change to lower cutting angle, primary relief. |

| Problem | Possible Cause | Possible Solution |
|---|---|---|
| Breakage | Lack of rigidity (workpiece) | Tighten workpiece fixture - a common problem. |
| | Lack of rigidity (workpiece) | Increase the cutting speed RPM's (n). |
| | Feed too high | Decrease feed per tooth (fz). |
| | Heavy depth of cut | Reduce width of cut, radial depth of cut (ae) & depth of cut, axial depth of cut (ap). |
| | Part entry | Reduce FPT on entry - implement radius in or sweeping entrances - avoid 90° (perpendicular) entry. |
| | Milling strategy | Review tool path and ensure there are no arbitrary moves, extreme arc of engagement increases & undesirable situations for the tool. Keep constant radial engagement. |
| | Tool overhang | Ensure you are using shortest OAL possible, stub tool in holder. Utilize stronger necked tool for longer reaches. |
| | Tool runout | Check tool runout in holder/spindle, <.0003" (.007 6mm) desired. Hand ground flats can be suspect and common cause. Use collet, milling chuck, or shrink fit holders if possible. |
| | Excessive edge wear | Recondition at earlier stage. Factory recondition service is recommended. |
| Built Up Edge (BUE) | Chip welding to cutting edge | Utilize proper tool coating for workpiece material being cut. Climb mill preferred. |
| | Feed too low | Increase feed per tooth (fz). |
| | Speed too low | Increase the cutting speed RPM's (n). |
| | Coolant strategy | Add coolant or readjust coolant flow, use through tool coolant if available. Check coolant mixture concentration. |
| Chip Packing | Insufficient chip room | Use end mill with fewer flutes. |
| | Feed too high | Decrease feed per tooth (fz). |
| | Heavy depth of cut | Reduce width of cut, radial depth of cut (ae) & depth of cut, axial depth of cut (ap). |
| | Not enough coolant | Apply more coolant to flush chips. Use air pressure or op. stop to clear chips away. |
| | Large heavy chip | Utilize chipbreaker style tool to cut chip size. |
| Poor Surface Finish | Feed too high | Decrease feed per tooth (fz). |
| | Speed too low | Increase width of cut, radial depth of cut (ae) to stabilize tool in cut. |
| | Too light width of cut | Increase width of cut, radial depth of cut (ae) to stabilize tool in cut. |
| | Tool runout | Check tool runout in holder/spindle, <.0003" (.00 76mm) desired. Hand ground flats can be suspect and common cause. Use collet, milling chuck, or shrink fit holders. |
| | Built up edge | Use flood coolant. |
| | Recutting chips | Redirect/Evaluate coolant flush – or use fewer number of flutes. |
| | No end tooth concavity | Add margin (touch primary with oilstone). |

| Problem | Possible Cause | Possible Solution |
|---|---|---|
| Chatter/Vibration | Lack of rigidity (workpiece) | Tighten workpiece figure – a common problem. |
| | Lack of rigidity (machine & holder) | Use better machine tool holder or change condition. |
| | Tool runout | Check tool runout in holder/spindle, <.0003" (.0076mm) desired. Hand ground flats can be suspect and common cause. Use collet, milling chuck, or shrink fit holders if possible. |
| | Speed too high | Reduce the cutting speed RPM's (n). |
| | Feed too low | Increase feed per tooth (fz). |
| | Chip too thin | Utilize chip thinning adjustment multiplier. |
| | Arc of engagement violation | Use smaller tools and generate corner radii in pockets. Avoid tools that diameter matches workpiece corner radius, or rough plunge corners. |
| | Milling strategy | Ensure you are climb milling unless workpiece material has hard/abrasive outer skin or high impact tool steel like D2, then conventional milling technique is preferred for breakthrough. |
| Tool Deflection | Tool overhang | Ensure you are using shortest OAL possible, stub tool in holder. Utilize stronger necked tool for longer reaches. |
| | End mill diameter | Increase diameter of end mill for higher strength to length ratio. |
| | Increase number of flutes | Higher number of flutes = larger core diameter = increased strength. |
| | Feed too high | Decrease feed per tooth (fz). |
| | Too high width of cut | Decrease width of cut, radial depth of cut (ae). |
| | Milling strategy | Climb milling can help reduce the amount of deflection in some cases. |
| No Dimensional Accuracy (Wall Tapered) | Coolant strategy | Add coolant or readjust coolant flow, use through tool coolant if available. Check coolant mixture concentration. |
| | Tool deflection | See Tool Deflection section above. |
| | Feed too high | Decrease feed per tooth (fz). |
| | Too high width of cut | Decrease width of cut, radial depth of cut (ae). |
| | Tool runout | Check tool runout in holder/spindle, <.0003" (.0076mm) desired. Hand ground flats can be suspect and common cause. Use collet, milling chuck, or shrink fit holders if possible. |