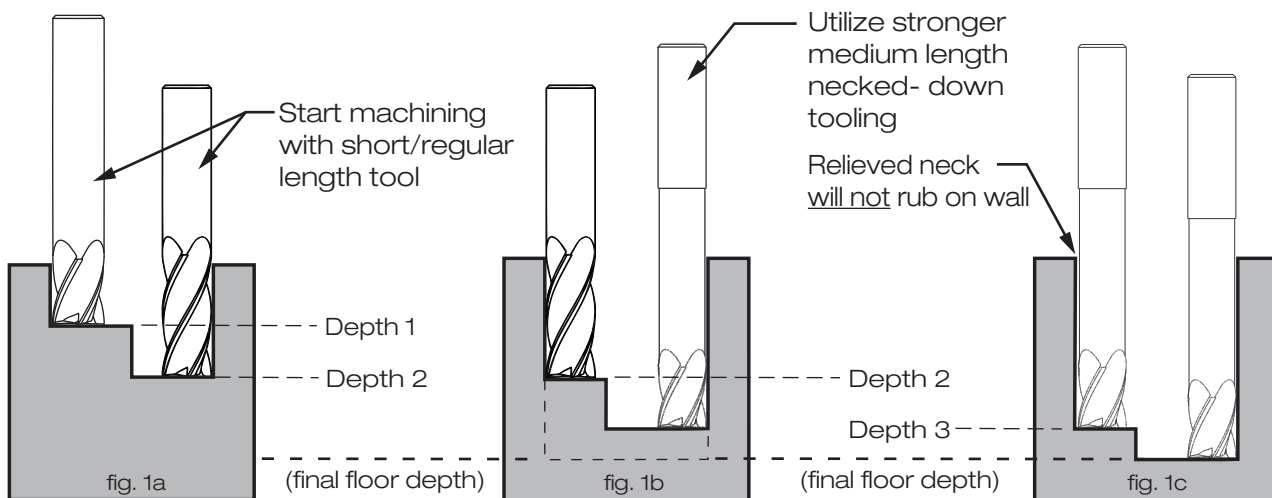Continues to be one of the most demanding milling operations. Deep pocket milling routines usually involve long reach, poor chip evacuation, limited coolant delivery, deflection issues and serious tool engagement violations. We have illustrated some helpful techniques below (see fig. 1a, 1b, 1c).

Common problems experienced;

- ◤ Chatter
- ◤ Tool deflection
- ◤ Recutting chips

- ◤ Wall taper
- ◤ Tool engagement violations
- ◤ Breakage

Some things to consider;

- ◤ *Step down milling routine* - this procedure (shown in fig. 1a,1b,1c) ensures that you are utilizing a controlled axial depth of cut (ADOC) at each level, thus optimizing speeds and feeds. It is imperative to start with a stub or standard length tool to get down to approximately 2-3 x dia. deep (depth 1-2), then employ necked down tooling.

- ◤ *Necked down tooling* - once depths 2 and 3 are reached (fig. 1b), use our stronger necked down tooling in order to maintain tool integrity and respectable feed rates. Necked tooling has a shorter length of cut (LOC), ensuring a much stronger tool and a neck diameter smaller than the cut diameter allowing for plenty of wall clearance.

- ◤ *Volumill Toolpath* - we have had tremendous success while using the VoluMill tool path with this pocketing strategy. This optimized tool path ensures tool engagement violations are alleviated and allows for maximum speeds & feeds in deep pocketing situations (see pg. 51).

Start machining with short/regular length tool

Utilize stronger medium length necked- down tooling

Relieved neck will not rub on wall

Depth 1
Depth 2

Depth 2
Depth 3

fig. 1a   (final floor depth)   fig. 1b   (final floor depth)   fig. 1c

Tool Deflection

Rigidity during a milling operation is key for optimum tool performance and desired part results. Keeping tool deflection to a minimum will help to increase success on a deep reach application.

force
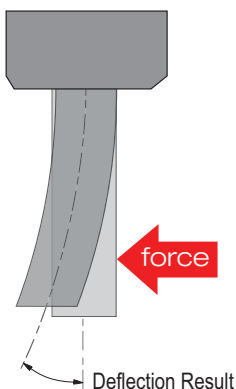
Deflection Result

- ◤ **A Deflection "Rule of Thumb"**
  - • Tool overhang length decreases rigidity as a third power (L^3), but even more importantly, tool diameter increases rigidity by the fourth power (D^4).

- ◤ **Common techniques to combat deflection**
  - • Ensure tools are sharp
  - • Increase tool diameter
  - • Decrease depth of cut
  - • Decrease IPM
  - • Climb mill in lieu of conventional milling
  - • Use shorter tool and/or employ necked tooling
  - • Increase number of flutes
  - • Re-evaluate SFM parameter