Overview

* What printer settings should be used to improve tapping viability?
  + Use fiber in concentric rings around the holes to be tapped.
  + Increase the number of wall layers around the holes to be tapped.
  + Increase the fill density of the part. Should use at least the default fill density value (37%).
  + Increase the number of roof & floor layers.
* What printer settings do not have a significant impact on tapping viability?
  + Layer height
  + Layer direction
  + Infill pattern
* In order, which settings are most important to improving tapping viability?
  1. Fiber,
  2. Number of wall layers,
  3. Fill density,
  4. Roof & floor layers,
  5. Layer height,
  6. Layer direction,
  7. Infill pattern.

Printer Setting vs Tapping Viability Details

* How does layer direction affect tapping viability?
  + The layer direction does not appear to have a significant effect on thread strength.
  + Since layer direction clearly does generally affect the strength of the part under most loading conditions, it is possible that further testing would reveal a more significant difference in strength when threading with or against the layer direction. However, preliminary testing reveals this effect to be minimal.
  + Since layer direction appears to have little affect on the viability of tapping and tapped holes can occur along many axes within a part, I recommend that layer direction is chosen to satisfy other design or printing requirements, instead of specifically for tapping considerations.
* How does fill density affect tapping viability?
  + Fill density affects tapping viability primarily in that it strengthens the region of the part surrounding the threaded hole, rather than strengthening the threads themselves.
  + For example, the default fill settings with a triangular fill pattern were sufficient to prevent fasteners from being pulled out axially. Increasing the fill density beyond this point did not significantly improve axial strength. However, increasing the fill density to its maximum value (57%) , or even using solid fill, did improve the strength of the threads with respect to radial loading on the fastener.
  + To prevent fittings/fasteners from pulling out, I recommend using at least the default fill density setting. If the fastener will experience primarily radial loading, I recommend increasing the fill density as much as possible to prevent pulling out and strengthen the nearby material.
* How does fill pattern affect tapping viability?
  + Fill pattern has no significant effect on tapping viability.
  + Rectangular fill yielded a slight improvement, but this is likely due to the inherent increase in fill density when using rectangular fill compared to other fill patterns.
  + I recommend choosing infill pattern based on other design considerations, and not tapping viability.
* How does layer height affect tapping viability?
  + The larger layer height test case caused the face of the part to rip off before pulling out the threads. This indicates that layer height may improve tapping viability.
  + Aside from this one test case, there was little relationship between the layer height and tapping viability.
  + I recommend using the largest layer height possible if surface finish or fit requirements do not necessitate a smaller layer height.
* How does the number of roof & floor layers affect tapping viability?
  + Roof & floor layers may slightly improve tapping viability, but this improvement is small.
  + I recommend increasing the root and floor layers to improve tapping viability. However, altering this property alone will likely not improve the results significantly.
* How does the number of wall layers affect tapping viability?
  + Increasing the quantity of wall layers significantly improves tapping viability.
  + The improvement here is second only to the addition of fiber about the holes.
  + The part may still suffer from weakness in the region beyond the wall layers.
* How does fiber affect tapping viability?
  + The addition of two concentric rings of carbon fiber around the thread holes significantly improved threading viability.
  + In this case, the material surrounding the hole broke before the threads pulled out, even under radial loads.
  + While other fibers have not yet been tested, they likely result in similar improvements.
  + I recommend using fiber around threaded holes when the other suggestions listed herein are insufficient to prevent threads from pulling through.