# Squish!

Printing the first layer can be frustrating for the do-it-all hobbyist since everything is always changing

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## Beginner squish

- Perform leveling, adjusting, calibrating the printer
- Print a Single Layer large box, (most of build plate) outline, or something similar and let it complete without intervention
- Inspect the single layer printed object while it prints (or immediately after)
  - Too close?
    - Smearing
    - Stringing
    - Dragging - stuck better to nozzle than bed
    - Pulling - stuck to nozzle
  - Too Far Away?
    - Not sticking
    - Dragging - not stuck to bed
    - Pulling - not stuck to bed
- Adjust nozzle height and print again until it looks *good enough!*

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## What *IS* good squish?

- **My Opinion -** It depends...  seriously!

When the material leaves the nozzle it's cross section is roughly circular but once touching the bed is deformed and hopefully stuck to the bed.  The resulting oval shaped filament string will have a flat bottom if it sticks to the bed at all, but the top of that oval and any other deformations from this point are exactly what we are discussing here.

Printing whatever filament successfully on a given printer can be performed over a fairly wide range of "filament squish levels", but the best performance, reliability, and quality come from dialing it as close to the middle of the range as possible which I believe helps to account for variations in filament diameter and build plate inconsistencies.

The extremes are easy; if the top if the oval almost looks round it means the nozzle needs to be closer to the bed, and if the oval is deformed to look completely flat the nozzle needs to be farther

from the bed.  The middle ground is tricky because each material being printed on each printer will have different preferences.

I begin with the nozzle well above the level I expect to actually print at, then dial it down while printing in the air until the material sticks nicely and has a visible flat on the top... this is the minimum squish, or highest Z offset if you prefer.

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## Materials prefer different heights

This is not based upon the material such as PLA vs PETG or ASA, but might be more individual to the specific color of each material from a given brand and how well that color wants to stick to the build surface being used.

When the best possible reliability and quality are desired, we need to calibrate each printer for each new material

- Print a test part
  - Warp - Long & thin to check for warping and adhesion issues
  - Tolerance - ensures filament thickness averages are being met!
- Start with less Squish for a new material
  - If there are ANY adhesion issues with a print line that just has the top flattened, squish a little more
  - Starting with too much squish can cause some materials to become permanently bonded to some build surfaces
    - In my experience, this can make repeat prints difficult prior to removal ;)
- Big changes are OK at the beginning
  - If there is an adhesion issue with the first "lightly flattened" test, I tighten the squish significantly
    - This is often too much but should FIX adhesion issues and maybe cause other issues
      - Too much squish can cause smearing and stringing among other issues
    - If we STILL have adhesion issues, its time to go back to the cleaners and maybe adhesives for troublesome materials

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## No PETG on PEI / PEX?

Some claim PETG should not be printed on PEI or PEX build plates without adhesive separation layers, and I believe they say it for liability reasons.

Many PETG filaments have a higher coefficient of adhesion at ~85c when compared to ABS or ASA at ~100c with the same nozzle/bed offset, but raising the nozzle height can alter this significantly. Raising the nozzle to a point of just flattening the top of the print line, seems to allow the same material to stick to the same sheet and pop off nicely after cool down like PLA in most cases.

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## No Silver Bullets!?!

Unfortunately this is a trial and ERROR process that *requires failing regularly*.

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