



## Improved DIY multicolor filament



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### Summary

DIY multicolor filament with improved profile, 1.75 or 2.85mm, several lengths, up to ~15m for 1.75mm or 9.5 for 2.85mm.

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These are models to print your own multicolor or “toothpaste” (not “rainbow”) filament, which renders extrusions in 2 or more different colors.

### What's the "improved" profile?

Whilst DIY multicolor filaments aren't new, all those that I've seen use a polygonal section (or profile): sometimes square, sometimes hexagonal or octagonal. This worsens the grip of the extruder on the filament, as there are only tangent points to the gear teeth (instead of a surface), and they have less material than the equivalent circular section. But, obviously, a cylinder is not directly printable, as we would have just a tangent point to the bed, which is the worst for first layer adhesion (there wouldn't be a layer, for starters).

These models have a section with the lower 3 sides of a (flat) octagon and a top arc of 225 degrees (see the picture). So, it gives a more rounded

shape when printed, and have a volume more akin to that of a purely circular section.

For the 1.75mm version, the minimum diameter of this filament is (nominal) 1.68339mm, with a 3.87% ovality, and a section area of 2.31537mm<sup>2</sup> when a pure circle of 1.75mm diameter has an area of 2.40528mm<sup>2</sup>; that is, a 96.26% of the volume. Printing at 0.1 or 0.05mm layer height will give you a minimum diameter of 1.7mm (if your printer is finely tuned, that is), just at the lower end of the 0.05mm usual tolerance for many commercial filaments.

For the 2.85mm version, the minimum diameter of the filament is (nominal) 2.74153mm, with the same 3.87% ovality, and a section area of 6.14093mm<sup>2</sup> against the 6.3794mm<sup>2</sup> (again, a 96.26% of the volume).

## How to print (it)

You'll get the best printing results at 0.1 or 0.05, given the height of the shape. For 2-color filament, you can set the color change just one layer above mid-print, greater than or equal to 0.9. (Remember that in PrusaSlicer the color change is called after the layer change, so put it in the first layer of the new color.) In any case, you can trust the PrusaSlicer preview to check that the amounts of all colors are similar/the same. You can play a bit with the first layer height (setting it at something like 0.18, for instance) to fit the best height.

**Be very careful** when doing the filament swap not to apply any side force; leave the machine do all the job. If you move the extruder header even a bit, the new color layers will be misaligned—which potentially can ruin your filament, making it far too out of spec to fit.

It's better to disable the Elephant Foot Compensation, and set the seams to Aligned, preferably at the inner start of the coil. That straight short tail is designed to be "expendable" to f.i. fit the coil in a spool; but if the retractions or filament dragging take it off bed, your filament won't be ruined. (If that start snaps off bed, you can even cut it while printing and finish the print with a successful coil.)

If you want to splice several lengths of filament, I suggest to print a mirrored version and joining both coils at the same end. That is, join them either at the start or the end of both spirals (but not start-to-end). The filament, as is printed, has a heavy tension in it (especially true with the most rigid filaments, such as PLA), which can lead to tangling. Another option is to not mirror the models and instead invert the color order, but if you do so then you must make well sure that you've set the color change as exactly as mid-height as you can, instead of "one layer above".

## How to print (with it)

The positioning of the filament is important, if you want to minimize it moving when printing (a common problem with "toothpastes"). For dual-gear extruders, such as the Bondtech in the Prusa i3 Mk3, it's better to place it so both gears are in contact with an arced side—that is, with either the printed top or bottom facing you, with the z-axis of the printed filament parallel to the extruder motor axis or rotated up to 45° towards Y). For longer filaments, this may force you to use some strange contraption to feed the filament from **the side** of the machine, instead of back/front, such as [Kaishou's Side Filament Guide for the Mk3](#). I haven't tried to use something that adds a bit of pretension to the feeding before the extruder (yet), but my (educated?) guess is that it will help.

That said, the rotation of the "moving" filament is pretty uniform (due to the existing pretension) and it adds a cyclical "spiral color change" effect that may be what you want. YMMV.

If you have the extruder+flat idler setup, it will be better to set the flat side (the flat bottom of the printed filament) in contact with the idler, and so the toothed gear will have a full contact arc.

Nonetheless, it's possible that you need to adjust the tension to make for those missing 0.05 or 0.07mm, and possibly the flow multiplier to compensate that 96% of the volume; a 5% flow increase would be more than enough. It's possible that you need to lower your retraction settings, as some of my tests showed that retraction effects (i.e, little gaps) are more likely to appear than in the original filament(s). Likely, the flow properties are slightly worse due to geometry.

## What to print (as filament)

It's better to use:

- Contrasting colors, either in hue (like opposites) or in luminance, like a light RAL Sky Blue with a dark RAL Ultramarine Blue, or black & white...
- Colors that are 120 degrees apart in a color wheel
- An achromatic color (white, gray, black) with a chromatic color
- Mixable colors, like red and yellow (that make orange). Also, think in the RBY or CMYK color spaces - NOT RGB. We're doing a subtractive model using pigments, not an additive one using light!
- Combinations of materials with similar temperatures (TPU and PETG), or multicolor for materials that are not available in multicolor (egr. PETG), or unavailable combinations (what about a silk glitter?).

- Non-uniform mixtures. You don't need to make 2 or 3 equal parts. For instance, try the pattern 1-2-1: 1 quarter white, 1 half of the color you want, 1 quarter black.
- Adding "interposition layers" with transparent or mid-range colors to improve the gradient.

## One final tip.

This model not only works to make multi-color filament, but also allows you to create your own blends and mixes. You only need to make a layered-color filament with the colors you want to blend, and then use that same filament to print yet another filament coil. With this, you can add a bit of transparency, glitters, glow-in-the dark or other properties. You'll obviously need a to print a first coil longer than the last one —that's why there are two variants per basic size! (Note: For the smaller sizes, you'll have to load the filament manually, instead of using the "Load Filament" menu option; just preheat, unload the previous filament, put the next and move slowly the extruder until the new appears. There is simply not much more to spend with the default loading length.)

## Model files

 **1.75mm** 8 files

**filament\_175mm\_1256m\_90\_to\_1099mm.stl**

**filament\_175mm\_1308m\_90\_to\_1099mm.stl**

**filament\_175mm\_5298m\_90\_to\_1509mm.stl**



**filament\_175mm\_537m\_90\_to\_1509mm.stl**



**filament\_175mm\_10036m\_90\_to\_1878mm.stl**



**filament\_175mm\_10127m\_90\_to\_1878mm.stl**



**filament\_175mm\_15182m\_70\_to\_2065mm.stl**



**filament\_175mm\_15302m\_70\_to\_2065mm.stl**



**2.85mm**

10 files



**filament\_285mm\_0672m\_90\_to\_1083mm.stl**



**filament\_285mm\_0623m\_90\_to\_1083mm.stl**



**filament\_285mm\_2106m\_90\_to\_1335mm.stl**



**filament\_285mm\_2168m\_90\_to\_1335mm.stl**



**filament\_285mm\_3427m\_90\_to\_1524mm.stl**



**filament\_285mm\_3498m\_90\_to\_1524mm.stl**



**filament\_285mm\_7819m\_90\_to\_2028mm.stl**



**filament\_285mm\_7915m\_90\_to\_2028mm.stl**



**filament\_285mm\_9585m\_70\_to\_2077mm.stl**



**filament\_285mm\_9684m\_70\_to\_2077mm.stl**



**PrusaSlicer 3MF examples**

6 files



**filament\_175mm\_1256m\_90\_to\_1099mm.3mf**



**filament\_121\_pattern\_175mm\_1308m\_90\_to\_1099mm.3mf**



**filament\_175mm\_1308m\_90\_to\_1099mm.3mf**



**filament\_175mm\_537m\_90\_to\_1509mm.3mf**



**filament\_175mm\_10127m\_90\_to\_1878mm.3mf**



**filament\_175mm\_15302m\_70\_to\_2065mm.3mf**

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