

**FILAMENT PM**

Application note for 3D printing

# Filament PM PLA-LW: settings, calibration and weight savings

*Measured on a Prusa CORE One printer with a 0.4 mm nozzle*

## 1 Introduction and key benefits

Filament PM PLA-LW is an actively foaming PLA. When heated in the nozzle, the material starts to expand, the extrusion bead increases in volume and the printed part becomes significantly lighter. The degree of foaming is controlled mainly by the nozzle temperature and the material flow (extrusion multiplier). This note summarizes our measurements and the settings derived from them.

- **Weight savings of 60%:** a 3DBenchy boat printed with the Filament PM profile weighed 4.30 g, without foaming 10.80 g. The density of the printed wall drops from 1.18 to approximately 0.47 g/cm<sup>3</sup>.
- **One spool does the work of two and a half:** with the recommended settings, one kilogram of PLA-LW prints as many parts as you would need roughly 2.5 kg of regular PLA for.
- **Matte surface** with a fine foam structure that hides layer lines and takes color well.
- **Adjustable density:** a higher temperature and a lower flow mean a lighter part.
- **Applications:** RC models, drones, scale models, cosplay and other parts where weight matters more than strength.

### Before you start

The results apply to a specific printer, nozzle and settings. Any change in temperature, speed, layer height or nozzle changes the foaming. Treat them as an introduction to the topic and verify the settings with a calibration print according to Chapter 3.

## 2 Methodology and test setup

- Prusa CORE One printer, 0.4 mm nozzle, PrusaSlicer 2.9.6
- Specimen: Ø50 × 10 mm cylinder in spiral mode, one perimeter, 0.50 mm extrusion width
- Temperature series 200–270 °C in 10 °C steps, multiplier 1.00, speed 50 mm/s
- Wall thickness: calipers, 4 readings around the circumference; reading accuracy on soft foam estimated at ±0.1 mm
- Weight: digital scale with 0.01 g resolution
- Verification: 3DBenchy boat without foaming and with the calibrated settings



Fig. 1 Samples of the 200–270 °C temperature series, multiplier 1.00. Higher temperature gives a thicker wall and rougher surface.

### Material preparation: drying

Foaming materials are sensitive to moisture. Wet filament foams unevenly and oozes significantly more from the nozzle. Before printing we recommend drying the spool at 50–55 °C for 6–8 hours and keeping it dry during printing. We did not measure the effect of drying separately; it is based on experience from practical prints.

### 3 Expansion results and flow calibration

We printed the cylinders with the extrusion width set to 0.50 mm and a multiplier of 1.00; only the nozzle temperature was varied. Expansion states how many times thicker the measured wall is than the set 0.50 mm.

| Temperature   | Wall thickness | Expansion   | Assessment                                             |
|---------------|----------------|-------------|--------------------------------------------------------|
| 200 °C        | 0.48 mm        | 1.0×        | no foaming                                             |
| 210 °C        | 0.48 mm        | 1.0×        | no foaming                                             |
| 220 °C        | 0.51 mm        | 1.0×        | no foaming                                             |
| 230 °C        | 0.63 mm        | 1.3×        | foaming starts                                         |
| <b>240 °C</b> | <b>0.85 mm</b> | <b>1.7×</b> | <b>recommended range, working point of the profile</b> |
| 250 °C        | 1.00 mm        | 2.0×        | recommended range                                      |
| 260 °C        | 1.15 mm        | 2.3×        | upper limit of the recommended range                   |
| 270 °C        | 1.36 mm        | 2.7×        | not recommended, measured only to map the behavior     |

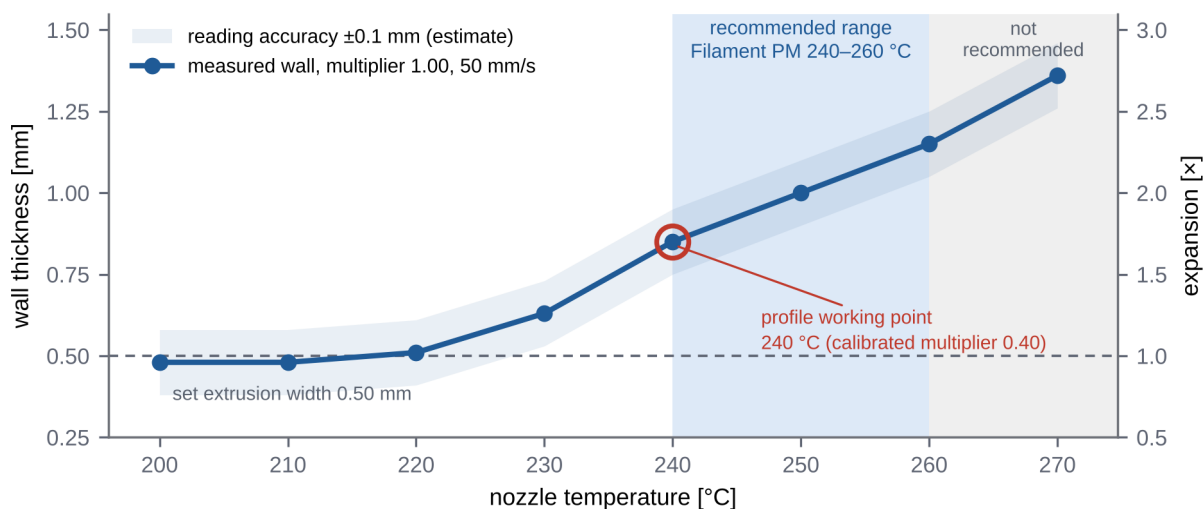


Fig. 2 Wall thickness as a function of nozzle temperature. The recommended print range for Filament PM is 240–260 °C.

The material starts to foam between 220 and 230 °C and foams more as the temperature rises. We printed at 270 °C only to see the behavior beyond the recommended limit. We do not recommend it for regular printing: oozing increases with temperature and the surface gets worse. Foaming also depends on speed: at slower printing we measured a thicker wall, which is why the profile keeps a constant speed of 50 mm/s.

#### Flow calibration

The table shows foaming at full flow, not the correct extrusion multiplier. With reduced flow the material foams even more, so the correct multiplier cannot be read from the table or calculated in advance and has to be found by printing. For 240 °C and 50 mm/s, a value of 0.40 gave a 0.50 mm wall.

1. Set the temperature, speed, layer height and extrusion width you want to print with.
2. Print a Ø50 mm cylinder in spiral mode with a multiplier in the recommended range of 0.30–0.70. For 240 °C, start at 0.40.
3. Measure the wall thickness at four places and average the values.
4. If the wall is thicker than the set width, reduce the multiplier by 0.05; if it is thinner, increase it. Repeat the print. Differences of up to 0.1 mm cannot be reliably resolved with calipers on foam.

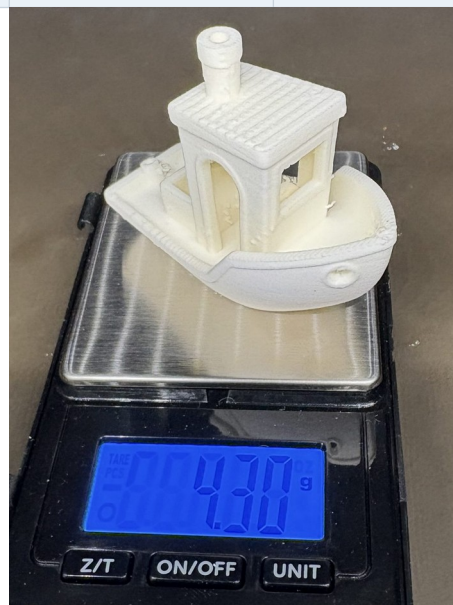
## 4 Practical weight savings

We verified the savings on a 3DBenchy boat (0.20 mm layer, 15% grid infill, 0.50 mm extrusion width, 50 mm/s).

| Setting             | Temperature / multiplier | Weight  | Savings      |
|---------------------|--------------------------|---------|--------------|
| No foaming          | 210 °C / 1.00            | 10.80 g | –            |
| Filament PM profile | 240 °C / 0.40            | 4.30 g  | 6.50 g (60%) |



a) without foaming, 210 °C: 10.80 g



b) Filament PM profile, 240 °C: 4.30 g

**Fig. 3** The foamed boat is lighter in color and matte, details are preserved. Fine strings from oozing are visible near the cabin window.

At the same settings, the weight is roughly proportional to the extrusion multiplier, so with a value of 0.40 it comes to about 40% of the original weight. For illustration, for thin-walled models (rough conversion, not measured): drone cover 80 g → 32 g, RC model fuselage 250 g → 100 g, wing 400 g → 160 g. In practice this means that one spool of PLA-LW prints as many parts as you would need roughly 2.5 spools of regular PLA for.

Strings from travel moves can be removed with a sharp knife and light sanding. The matte surface takes primer and paint well.

## 5 Recommended print profile (Quick-Start)

| Parameter                          | Value                            | Note                                                                                             |
|------------------------------------|----------------------------------|--------------------------------------------------------------------------------------------------|
| Nozzle temperature                 | 240 °C, also first layer         | at multiplier 0.40 the first layer must foam too, otherwise it lacks material and does not stick |
| Bed temperature                    | 60 °C                            |                                                                                                  |
| <b>Extrusion multiplier</b>        | <b>0.40</b>                      | <b>result of calibration for 240 °C and 50 mm/s</b>                                              |
| Density in slicer                  | 1.20 g/cm <sup>3</sup>           | density of unfoamed filament                                                                     |
| Layer height / extrusion width     | 0.20 mm / 0.50 mm                | enter the width manually                                                                         |
| Perimeter generator                | Classic                          | Arachne changes the wall width and breaks the calibration                                        |
| Speed                              | 50 mm/s for all print moves      | minimum print speed also 50 mm/s, dynamic overhang slowdown disabled                             |
| Cooling                            | 85–100%                          |                                                                                                  |
| Retraction                         | 2 mm, 40 mm/s, deretract 25 mm/s | do not increase, longer retraction raises the risk of clogging                                   |
| Min. travel for retraction / Z-hop | 0.5 mm / 0.4–0.6 mm              | nozzle wiping during retraction enabled                                                          |
| Material drying                    | 50–55 °C, 6–8 hours              | wet filament oozes significantly more                                                            |
| <b>Build plate</b>                 | <b>PEI with a release layer</b>  | <b>Magigoo Original or 3DLAC</b>                                                                 |

Ready-made profiles for Prusa CORE One and Bambu Lab P1S with a 0.4 mm nozzle can be downloaded at [www.filament-pm.cz](http://www.filament-pm.cz). The settings are identical for both printers.

## 6 Important notes for users

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### Strength, especially between layers

Foamed material is significantly weaker and less stiff than a solid print. Strength drops faster than weight, and the weakest point is the layer bonding along the Z axis. Use PLA-LW for parts where weight is what matters. Load-bearing joints, threads and screw mounts should be printed from solid material or reinforced. We did not measure the mechanical properties of Filament PM PLA-LW.

### Oozing, strings and moisture

Gas in the melt expands even during travel moves, so material oozes and strings form. They are noticeably thicker than with regular PLA, because even the oozed material foams. On the other hand, they are brittle and easy to remove with a knife and light sanding. Do not expect a foamed print to come out as clean as one in regular PLA.

The amount of strings rises significantly with the moisture of the filament, so dry the material before printing and keep it dry. Retraction helps only to a limited extent, and a retraction that is too long can pull foamed material into the cold part of the hotend and clog the nozzle, so do not increase it. The most effective approach is to choose models with as few travel moves as possible.

### Cooling of small details

The constant speed of 50 mm/s means the printer does not slow down for cooling on small layers. Fine details and thin tips may therefore come out with a worse shape. Do not fix this by slowing down, as it would change the foaming. Printing several parts at once gives the layers more time to cool, but adds travel moves and therefore strings.

### Build plate protection

PLA-LW sticks to PEI exceptionally well, especially on a textured surface. Adhesion is significantly higher than with regular PLA, and without a release layer there is a risk of damaging both the plate surface and the print itself, because the foamed material is soft and tears off when pried. Always apply a thin layer of Magigoo Original or 3DLAC before printing, and remove the part only after the plate has cooled completely.

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*The results apply to measurements on a specific device, with specific equipment and at a specific time. Deviations are possible; always verify the settings on your own printer. Filament PM, [www.filament-pm.cz](http://www.filament-pm.cz), September 2026*