What fan speed should you use for PLA?

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Abstract. Run PLA's part cooling fan at 100%, off on the first layer for bed adhesion. Prusament's data sheet says 100%; some printer profiles start at 50 to 85% and ramp up.

Keywords: part-cooling, pla, slicer-settings

Table 1. The number

Slicer profile (printer)	First layer	After the first layer	Bridges and overhangs
PrusaSlicer, Prusament PLA (MK3S, MK4)	Off	Ramps up, 100% from layer 4 (layer 3 on the MK4)	100%
PrusaSlicer, Prusament PLA (MK4S)	Off	70%, climbing toward 100% on layers shorter than 17 s	100%
PrusaSlicer, Prusament PLA (Core One)	Off	85%, climbing toward 100% on layers shorter than 40 s	100%
Bambu Studio, Bambu PLA Basic (X1C, X1, P1S, P2S)	Off	100% from layer 2	100%
Bambu Studio, Bambu PLA Basic (A1, A1 mini)	Off	60%, climbing toward 80% on layers shorter than 80 s	100%
Bambu Studio, Bambu PLA Basic (H2D)	Off	60%, climbing toward 80% on layers shorter than 100 s	100%
Bambu Studio, Bambu PLA Basic (P1P)	Off	50%, climbing toward 100% on layers shorter than 80 s	100%
Cura, Generic PLA (Cura's defaults)	0%	100% from layer 2; full at layer 4 on Creality printers	100%, with bridge settings turned on

1 What fan speed should you use for PLA?

Run the part cooling fan at 100% for PLA, off on the first layer for bed adhesion. Prusament's data sheet lists 100%, and PLA profiles in PrusaSlicer (MK3S, MK4), Bambu Studio (X1C, P1S) and Cura reach it by layer 2 to 4. Some profiles start at 50 to 85% and ramp up on short layers.

1.1 The number

The values, including the layer at which each profile's settings reach full fan, are read from PrusaSlicer 2.9.6′s PrusaResearch.ini, Bambu Studio v02.08.02.61′s BBL filament profiles and Cura 5.13.0′s fdmprinter and Creality definitions with the Generic PLA material, each with its inherited parent profiles resolved.

1.2 Why does PLA need so much cooling?

PLA leaves the nozzle at 190 to 230 °C (Bambu's nozzle range) and stays soft until it cools below its glass transition: 60 °C on Bambu Lab's PLA Basic data sheet, 61 °C on Polymaker's PolyLite PLA sheet. Each line has to cool past that point before the next layer lands. If it has not, Prusa's cooling guide warns, the nozzle pushes the soft layer around and out of shape.

Bridges and overhangs need it most, because those lines have nothing under them: with the fan on, Bambu's PLA Basic data sheet gives a 55° maximum overhang angle and a 30 mm maximum bridge length (why overhangs droop).

1.3 What if your printer's PLA profile starts below 100%?

Start from that profile, not from a number copied off another machine. Those profiles raise the fan as layers get shorter, up to their top figure. A fan percentage is a share of that printer's own fan maximum (Prusa's cooling guide defines it as a percentage of the fan's max RPM), so 60% on one printer is not the same airflow as 60% on another.

1.4 Should the fan be off for the first layer of PLA?

Yes. PrusaSlicer's and Bambu Studio's PLA profiles and Cura's defaults all start with the fan off on layer 1. PrusaSlicer's tooltip says this is so the fan "does not make adhesion worse", and Bambu Studio's says the first-layer fan is closed "to get better build plate adhesion".

From layer 2 the profiles differ. Bambu Studio and Cura's defaults go straight to full speed. PrusaSlicer ramps the fan up linearly, and its Prusament PLA profiles reach full fan at layer 4 (layer 3 on the MK4, MK4S and Core One). Cura's Creality definitions set a higher "Regular Fan Speed at Height", which also puts full fan at layer 4.

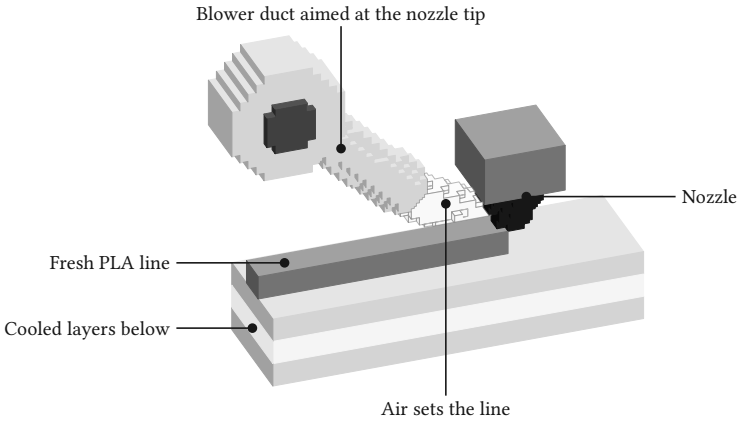


Figure 1. The part cooling fan blows through the duct onto the line the nozzle just laid, so the PLA sets before the next layer goes down on it.

If a large, flat PLA part lifts at the corners, keep the fan off for a few more layers. Prusa's cooling guide says many filaments do better with cooling skipped for the first 1 to 5 layers, to stop warping and the print coming off the bed (a print warped at one corner).

1.5 Does PLA still need the fan in an enclosed printer?

Yes, and the enclosure makes the fan's job harder. Bambu Lab's wiki says a warm chamber heats the air the part cooling fans blow, so cooling and print quality suffer. The warm air can also soften PLA in the hotend before it reaches the nozzle (heat creep). The wiki's rules:

- **Chamber:** keep it at least 10 degrees below the filament's glass transition.
- **PEI (polyetherimide) plate:** print PLA with the front door open or the top cover off.
- **Cool Plate, with the bed at about 35 °C:** PLA can print with the door and top cover closed.

PrusaSlicer's Prusament PLA profile for the enclosed Core One still runs the part fan at 85 to 100%.

1.6 Do you need a part cooling fan for PLA?

Yes. Every PLA data sheet checked here calls for one: Prusament's lists 100%, Bambu Lab's PLA Basic sheet says "turn on" and Polymaker's PolyLite PLA sheet says "ON". Without it, overhangs droop and small parts go soft. Printing without a cooling fan covers what still works.

1.7 How to check it on your own print

- **PrusaSlicer:** Filament Settings > Cooling (Expert mode) holds "Fan speed" Min and Max, "Bridges fan speed", "Disable fan for the first" and "Full fan speed at layer".
- **Bambu Studio:** the filament's edit icon > Cooling > Part cooling fan holds "Initial layer fan", "Min fan speed threshold", "Max fan speed threshold" and "Fan speed for overhang".
- **Cura:** Print Settings > Custom > Cooling holds "Fan Speed", "Initial Fan Speed" and "Regular Fan Speed at Height".
- **Leave "Keep fan always on" ticked in PrusaSlicer.** With it unticked, the fan stays off on any layer that takes longer than "Enable fan if layer print time is below" (100 s in the Prusament PLA profile), bridges aside. The setting's tooltip: "Useful for PLA, harmful for ABS."
- **Read the fan in the preview.** Set PrusaSlicer's or Bambu Studio's G-code preview to color by fan speed: layer 1 should show 0% and later layers your profile's value.
- **Print a bridge or overhang test.** If PLA still droops at 100% fan, check that the fan spins and that its duct is seated and aimed at the nozzle tip (what the part cooling fan does).
- **If small parts go soft,** raise the minimum layer time: "Slow down if layer print time is below" in PrusaSlicer (12 s in the MK3S Prusament PLA profile), the "Max fan speed threshold" layer time in Bambu Studio (4 s on the X1C) or "Minimum Layer Time" in Cura (5 s by default). Why small prints melt lists the values for other printers.

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