Why does my 3D printer nozzle keep clogging?

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Published October 15, 2026 · Last verified October 15, 2026

Abstract. Repeat clogs are usually heat creep: Prusa flags rooms above 35 °C and enclosed PLA. Wet or dirty filament, printing too cold and long retractions cause the rest.

Keywords: slicer-settings, pla, enclosures

1 Why does my 3D printer nozzle keep clogging?

Most often it's heat creep. The cold end of the hotend gets warm enough to soften filament before it reaches the melt zone. Prusa flags rooms above 35 °C and enclosed PLA prints, and Bambu Lab says PLA clogs most. The other repeat causes are wet or dirty filament, printing too cold or fast, long retractions and leftover plastic.

1.1 The number

Table 1. The number

Cause	Fix and setting	Source
Heat creep from a warm room or enclosure (more)	Keep the room under 35 °C (30 °C for some filaments). Keep an enclosure at least 10 °C below the filament's glass transition. For PLA in an enclosed printer, open the door or lift the top cover	Prusa, Bambu Lab
Weak, dusty or reversed hotend fan	Fan on whenever the hotend is hot, blowing into the heatsink. Prusa's MK3-family printers read 4000 to 4400 RPM	Prusa, Polymaker
Hot bed heating the chamber	On a Bambu P1S with PLA, run the Textured PEI plate at 55 °C with the door open, or the Cool Plate at 35 °C	Bambu Lab
Nozzle too cold or print too fast	Raise the nozzle 5 to 10 °C, or cut speed or volumetric flow	Polymaker, Bambu Lab
Nozzle too hot	Lower it in 5 to 10 °C steps	Polymaker, Prusa
Too little flow: thin layers, slow small parts	0.15 or 0.20 mm layers, speed up 10 percent (under 200 mm/s)	Prusa
Long retractions	Direct drive at 2 mm at most on Prusa's MK3 family; the Bowden MINI defaults to 3.2 mm	Prusa, Polymaker, E3D
Wet filament (more)	Store sealed or in a dry box; dry hygroscopic filaments before printing. PA, PC and fiber-filled grades are the most sensitive	Bambu Lab
Leftover plastic after a material change (more)	After a high-temperature filament: unload at 250 to 300 °C, push the new filament through, extrude while cooling to 220 to 240 °C	Bambu Lab
Dust, debris, oversized or ground filament	Diameter within 1.75 ± 0.03 mm on calipers; replace the nozzle if debris stays	Bambu Lab, Polymaker, UltiMaker
Particles in carbon fiber, glow or sparkle filament (more)	Clear the tip with the cleaning pin, then do regular cold pulls	Bambu Lab
Carbonized residue from a nozzle left hot (more)	Unload while the hotend is still hot after each print; combine short jobs; cold pull at least once a month	Prusa, Bambu Lab, Polymaker
Nozzle too close to the bed	Raise it with Live Adjust Z or first layer calibration	Prusa
Gap between the PTFE tube and the nozzle	Push the tube fully down onto the nozzle or heatbreak	Polymaker, E3D

The settings come from Prusa's Knowledge Base (heat creep, first layer and stringing articles), Bambu Lab's wiki (how to avoid nozzle clogs, what is heat creep, the X1/P1 unclogging procedure), Polymaker's nozzle clog guide, E3D's V6 HotEnd support page and UltiMaker's feeder grinding article. PLA is polylactic acid, PA is nylon (polyamide) and PC is polycarbonate. PTFE (polytetrafluoroethylene) is the white liner tube.

1.2 Why do 3D printer nozzles clog?

A hotend needs a sharp step from hot to cold. Bambu Lab's wiki says filament that softens or swells above the melt zone, inside the heatbreak, can't be pushed through reliably. PLA and TPU (thermoplastic polyurethane) suffer most because of their low glass transition temperature.

Retractions and tube gaps lock a clog in place. Polymaker notes that long retractions pull semi-molten filament into cooler zones, where it sets. A gap at a PTFE-lined nozzle gives molten plastic a pocket to collect in and carbonize.

Particles finish the job. Bambu Lab lists carbon fiber, glow and sparkle fillers and debris riding in on the filament. It also lists plastic left over from a very different material, such as PLA after PC.

1.3 Why does my printer clog mid print?

Because heat builds up during the job. Bambu Lab's example print ran normally at first and clogged partway through, after the heat sink overheated. Bambu Lab puts it down to a hot enclosure or a failing hotend fan.

Its P1S chamber fan only switches on for PLA above a 50 °C bed. In a warm room, Bambu Lab warns, even that may not keep the chamber cool enough.

Flow matters as well. Prusa points out that moving filament carries heat away. Thin layers and slow, small sections move too little of it, and heat creeps up the heatbreak.

1.4 Why does it clog every few hours at the same layer?

The height tells you which causes to chase. If a clog comes back at the same layer on every attempt, look at what the G-code does there. Small, slow layers match Prusa's low-flow cause, and runs of short moves with many retractions match Polymaker's retraction cause.

If clogs come at a different height each time after hours of printing, heat soak fits better. Check the chamber, the bed temperature and the hotend fan.

1.5 How to check it on your own print

- **Watch the hotend fan.** It should spin whenever the hotend is hot, with no dust in the heatsink fins. On a Prusa MK3-family printer, read the speed in LCD Menu, Support, Extruder info.
- **Feel the room and the chamber.** Above 35 °C, or PLA behind a closed door, treat heat creep as the suspect. Print the next PLA job with the door open.

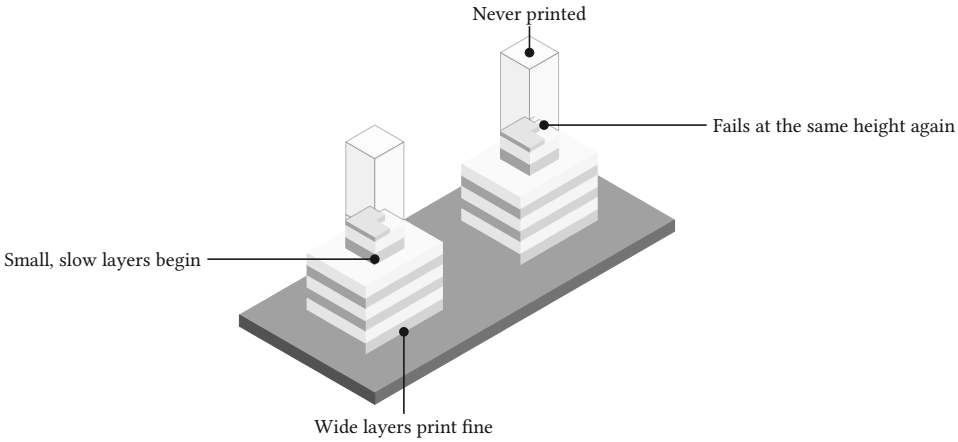


Figure 1. A clog that returns at the same layer on every attempt points at what the print does there, such as small, slow layers that move too little filament to carry heat away.

- **Measure the filament.** Take a few caliper readings along the spool. Anything outside 1.75 ± 0.03 mm is suspect, as are visible lumps or specks.
- **Cut the retraction.** Shorten it and reprint the layer that failed. Prusa caps its direct-drive MK3 family at 2 mm.
- **Check the PTFE tube.** On a lined hotend, make sure the tube sits fully down on the nozzle or heatbreak, with no gap.
- **Look at the first layer.** If nothing comes out from the first line, the nozzle may be too close to the bed. Prusa's clog signs are thinner lines, filament curling up at the tip and a clicking extruder.

To clear the clog you have now, follow the unclogging steps, then a cold pull.

1.6 How to prevent a 3D printer nozzle from clogging

Keep PLA cool, dry and moving. Print it in an open or vented printer and store filament sealed. Don't leave filament sitting in a hot, idle nozzle. Bambu Lab adds a cold pull at least once a month, especially when you switch filament types.

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Cite as: Asked 3D. "Why does my 3D printer nozzle keep clogging?." October 15, 2026. https://asked3d.com/answers/nozzle-keeps-clogging. Last verified October 15, 2026.