What should retraction speed be?

Asked 3D Content Team
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Abstract. Use your profile's value: 30 mm/s on Bambu Lab printers, 35 to 45 mm/s on Prusa's direct-drive printers, 70 mm/s on the Bowden Prusa MINI, 25 mm/s in Cura.

Keywords: retraction, slicer-settings

Table 1. The number

Printer	Slicer	Retraction speed	Deretraction (prime) speed
Bambu Lab X1 Carbon, P1S, A1, A1 mini (direct drive)	Bambu Studio	30 mm/s	30 mm/s
Bambu Lab H2D, both nozzles	Bambu Studio	30 mm/s	30 mm/s
Prusa MK3S, MK3S+ (direct drive)	PrusaSlicer	35 mm/s	0, which means 35 mm/s
Prusa MK4S, XL (direct drive)	PrusaSlicer	35 mm/s	25 mm/s
Prusa Core One (direct drive)	PrusaSlicer	45 mm/s	25 mm/s
Prusa MINI, MINI+ (Bowden)	PrusaSlicer	70 mm/s	40 mm/s
UltiMaker S5	UltiMaker Cura	45 mm/s	15 mm/s
Creality Ender 3	UltiMaker Cura	25 mm/s (no override)	25 mm/s
Any printer without its own value	Cura default	25 mm/s	Follows Retraction Speed
Any printer without its own value	Bambu Studio, OrcaSlicer default	30 mm/s	0 (same as retraction)
Any printer without its own value	PrusaSlicer default	40 mm/s	0 (same as retraction)

1 What should retraction speed be?

Use the value your printer's own profile ships: 30 mm/s on Bambu Lab printers in Bambu Studio, 35 to 45 mm/s on Prusa's direct-drive MK3S, MK4S, XL and Core One, 70 mm/s on the Bowden Prusa MINI, and 25 mm/s in UltiMaker Cura by default. Faster cuts stringing only until the extruder skips or grinds.

1.1 The number

All values are for a 0.4 mm nozzle. The Bambu rows are machine profiles in Bambu Studio v02.08.02.61; the A1 and A1 mini inherit `fdm_bbl_3dp_001_common`, which sets 30. The Prusa rows are printer profiles in PrusaSlicer 2.9.6′s `PrusaResearch.ini`, and the Cura rows UltiMaker Cura 5.13.0′s `fdmprinter`, `ultimaker_s5` and `creality_base` definitions. The defaults come from each slicer's `PrintConfig.cpp` at those tags.

1.2 What does retraction speed do?

It sets how fast the extruder motor pulls filament back before a travel move. PrusaSlicer's tooltip says it "only applies to the extruder motor", so the print head's travel speed is a separate setting. Prusa's knowledge base says a higher value helps against stringing. Simplify3D's guide explains the low end: retract too slowly and plastic oozes out of the nozzle before the retraction finishes.

1.3 What happens if retraction speed is too high?

The drive gear outruns the filament. Prusa says a speed set too high "may skip steps in the motor". Simplify3D says the filament may separate from the hot plastic in the nozzle, or the drive gear may "grind away pieces of your filament". Its grinding guide says to look for small plastic shavings in the extruder, and gives a test: halve the retraction speed and see whether the grinding stops.

UltiMaker Cura sets a ceiling and a warning: Retraction Speed cannot exceed the printer's Maximum Speed E, and Cura flags any value above 70 mm/s. Cura's Creality definitions move the warning down to 50 mm/s, the Maximum Speed E they set, and the ceiling to 200 mm/s. Simplify3D puts the useful range at 20 to 100 mm/s, depending on the material.

1.4 Retraction distance vs speed: which matters more?

Distance. Simplify3D calls retraction distance "the most important retraction setting". Bambu Lab's profiles vary distance, not speed: on the X1 Carbon, Bambu Studio sets 0.4 mm on a 0.2 mm nozzle, 0.8 mm on a 0.4 mm and 3 mm on a 0.8 mm, at 30 mm/s for all three. Speed gets more weight on a Bowden printer: the MINI's profile pairs a 3.2 mm retraction, the longest of the Prusa printers above, with the highest speed in the table. Tune distance first (what retraction distance should be), then speed.

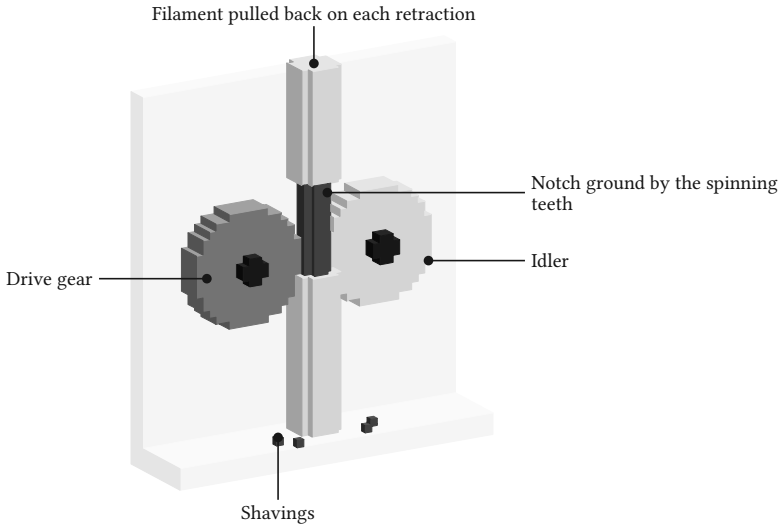


Figure 1. When retraction runs faster than the filament can follow, the drive gear keeps turning against it, grinds a notch and leaves shavings in the extruder.

2 Should retraction and deretraction speed be the same?

They can be, and all four slicers start that way. A Deretraction Speed of 0 means "same as retraction" in Bambu Studio, OrcaSlicer and PrusaSlicer. Cura's Retraction Prime Speed follows Retraction Speed. Bambu Lab ships 30 mm/s both ways. Prusa primes slower on the MK4S, XL, Core One and MINI: 35 out and 25 back on the MK4S.

2.1 What is retraction prime speed?

It is UltiMaker Cura's name for deretraction speed: how fast the filament is pushed back to the nozzle after the travel move. In Cura's Travel section, Retraction Speed has two children, Retraction Retract Speed and Retraction Prime Speed. Both copy Retraction Speed (25 mm/s by default) until you set one yourself. OrcaSlicer labels the same setting Deretraction Speed, and Bambu Studio and PrusaSlicer call it Deretraction Speed.

2.2 When do makers set them differently?

Prusa does it at the printer level (first table). UltiMaker and Prusa also do it per filament, and Bambu Lab slows both speeds for TPU. These filament profiles override the printer's values:

Table 2. When do makers set them differently?

Printer and filament profile	Retraction speed	Deretraction (prime) speed
UltiMaker S5, UltiMaker PLA, AA 0.4 core	45 mm/s	45 mm/s (follows Retraction Speed)
UltiMaker S5, UltiMaker PETG and ABS, AA 0.4 core	45 mm/s	15 mm/s
Prusa MK4S and Core One, Generic FLEX	60 mm/s	20 mm/s
Prusa MINI, Generic FLEX	40 mm/s	15 mm/s
Bambu Lab X1 Carbon, Bambu TPU 95A HF	10 mm/s	10 mm/s

The UltiMaker rows are Cura 5.13.0 quality profiles and the Prusa rows PrusaSlicer 2.9.6 filament profiles. The Bambu row is the `@base` filament profile in Bambu Studio v02.08.02.61, which its X1 Carbon variant inherits. The profile files give no reason for the split. If you change one speed, test it on its own and keep the other at the profile value.

2.3 How to check it on your own print

1. **Find the current values.** Bambu Studio and OrcaSlicer: printer settings, Extruder page, Retraction group; a filament profile can override both under Setting Overrides (where they are in Bambu Studio). PrusaSlicer: Printer Settings, Extruder 1, Retraction, in Advanced or Expert mode. Cura: the Travel section (where they are in Cura).
2. **Start from the profile values** in the first table, not from a number found for a different extruder.
3. **Calibrate distance first** with a retraction test (how to calibrate retraction distance). Keep speed at the profile value during the test.

4. **Change speed only if strings remain,** one value per test print, and stay under Cura's 70 mm/s warning or your printer's Maximum Speed E.
5. **Pull the filament out and look at it** if the extruder skips or you find shavings. A notch at the drive gear points to retraction that is too fast or too long. Halve the speed, as Simplify3D suggests; if the grinding stops, retraction was part of the cause.
6. **If strings survive tuned retraction,** look past retraction (why prints string).

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