Is 3D printed TPU waterproof?

Asked 3D Content Team
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Abstract. Yes, if printed well: TPU absorbs 0.18 to 1.08 percent water, and calibrated TPU walls held water 15 days in a 2023 test. Polyester TPU degrades in hot water.

Keywords: tpu, watertight, waterproofing

Table 1. The number: how much water TPU absorbs

Filament	Shore hardness	Water absorption	Test conditions
Bambu Lab TPU 95A HF	95A	1.08 percent	Saturated, 25 °C, 55 percent relative humidity (RH)
Polymaker PolyFlex TPU95-HF	95A	0.69 percent	Equilibrium, 23 °C, 70 percent RH
NinjaTek NinjaFlex	85A	0.22 percent	24 hours, ASTM D570
NinjaTek Cheetah	95A	0.18 percent	24 hours, ASTM D570

1 Is 3D printed TPU waterproof?

It can be. TPU (thermoplastic polyurethane) is insoluble in water and absorbs little, 1.08 percent at saturation for Bambu Lab TPU 95A HF. The print decides the rest. In a 2023 study, TPU walls printed with default settings had gaps, and after two slicer changes every wall held water for 15 days. Polyester-based TPU degrades in hot water.

1.1 The number: how much water TPU absorbs

The figures come from Bambu Lab's TPU 95A HF data sheet V1.0, Polymaker's PolyFlex TPU95-HF data sheet V5.5 and NinjaTek's technical specs chart. Each maker tests differently, so the rows are not directly comparable. None of the sheets reports a loss of strength from the absorbed water.

Under the same conditions, Bambu Lab measures its PLA Basic at 0.43 percent, so TPU takes up more water than PLA but stays insoluble. Moisture also matters before printing: the Prusa Knowledge Base warns that flexible filament is hard to print once it has absorbed moisture. Bambu Lab says to dry TPU 95A HF at 70 °C for 8 hours and to print and store it below 20 percent RH.

1.2 Why a TPU print can hold water

TPU bonds well between layers. The Prusa Knowledge Base says individual layers of TPU and TPEE (a polyester-based flexible filament) hold strongly together. In Prusa Research's watertight vase tests, TPEE held water with 3 perimeters, against 4 for PLA (polylactic acid) and PETG (glycol-modified PET). Prusa did not test TPU itself.

Layer bond alone does not seal a part. Suder and colleagues at VSB Technical University of Ostrava printed cups from Fiberlogy Fiberflex 30D, a TPU, on an Original Prusa i3 MK3S. With the default PrusaSlicer settings, microscope photos showed gaps between neighboring lines and between the infill and the perimeter. They confirmed that water leaks through the infill-to-perimeter gaps.

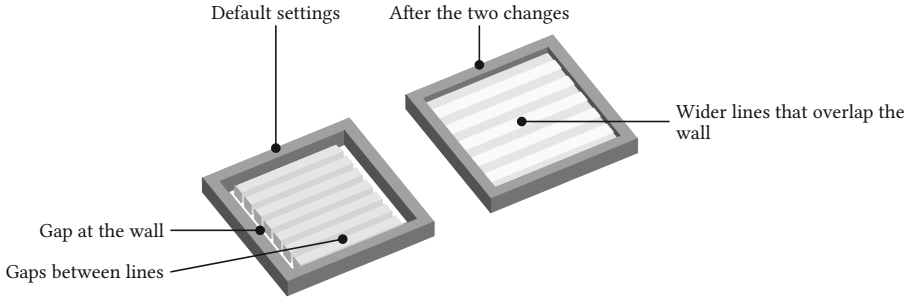


Figure 1. Under the microscope, default settings left gaps between the infill lines and where the infill met the perimeter; a wider line and more overlap closed them.

1.3 Settings that made TPU watertight

The study fixed the leaks with two changes. After each one, the authors checked the bottom of a test cup under a microscope:

1. **Extrusion width up to 0.49 mm**, from a base of 0.45 mm, until the infill lines touched with no gaps.
2. **Infill/perimeter overlap up to 80 percent**, from a base of 25 percent, until the infill fused to the wall.

The rest of the profile: 0.4 mm nozzle, 0.2 mm layers, 210 °C nozzle, 60 °C bed, 100 percent infill and 45 mm/s perimeters. TPU cups with walls from 0.4 to 1.6 mm each held 13 ml of water for 15 days with no visible leak. Their weight loss of 0.56 to 0.67 g matched evaporation. Even the 0.4 mm wall, a single perimeter, held. The authors note the values may differ on other printers, so treat them as the direction to move, not the target.

Under air pressure, the 0.8 mm TPU wall held 0.4 MPa and the 1.2 mm wall 0.5 MPa before tearing between layers. A sealing part such as a gasket or O-ring has its own design rules, covered in can you 3D print a gasket.

For speed, the Prusa Knowledge Base gives 20 mm/s as typical for flexible filament and 30 to 40 mm/s as the maximum. Bambu Lab rates its high-flow TPU 95A HF for under 200 mm/s.

1.4 Is 3D printed TPU water resistant in hot water?

In cold water, yes. In hot water it depends on the chemistry: polyether-based TPU resists it for years, while polyester-based TPU breaks down. BASF, maker of Elastollan TPU, states that long exposure to hot water, water vapor or tropical climates splits polyester-based TPU by hydrolysis. The strength loss is irreversible and worse in softer grades, but rare at room temperature.

Table 2. Is 3D printed TPU water resistant in hot water?

Tap water at	Polyester-based TPU	Polyether-based TPU
23 °C	Years	Years
60 °C	Months	Years

The table comes from BASF's chemical-resistance chart for its standard ester and ether Elastollan grades. Those are molding grades, not filament, so read it as the gap between the two chemistries rather than the life of any one spool.

The Bambu Lab, Polymaker and NinjaTek documents above do not say which base their TPU uses. Spectrum Filaments states that its S-Flex 98A is a thermoplastic polyether polyurethane with very high resistance to hydrolysis. For a part that sits in warm water for months, pick a filament whose maker states polyether, or ask the maker.

Water is not the only liquid to check. Bambu Lab rates TPU 95A HF as resistant to most oils and greases but not to acids or alkalis.

1.5 How to check it on your own print

1. Print the part with the settings above and let it cool.
2. Look at the underside and the inside of the wall with a magnifier. Gaps between lines call for a wider extrusion width. A gap where the infill meets the wall calls for more overlap.
3. Stand it on a dry paper towel, fill it with water, and check the towel and the seam after a few minutes.
4. If dry, leave it filled overnight and check again.

The timed version, with pass criteria, is on how to test a print for leaks.

References

[1] Bambu Filament Technical Data Sheet V1.0, TPU 95A HF. https://store.bblcdn.eu/s8/default/16df21baf482453999b3dbb61cc110e7/Bambu_TPU_95A_HF_Technical_Data_Sheet.pdf. Accessed October 10, 2026.

[2] Bambu Filament Technical Data Sheet V3.0, PLA Basic. https://wiki.bambulab.com/filament-acc/abs-asa-pc/bambu_pla_basic_technical_data_sheet.pdf. Accessed October 10, 2026.

[3] PolyFlex TPU95-HF Technical Data Sheet V5.5 (Polymaker). https://polymaker.com/wp-content/uploads/TDS_Polymaker_PolyFlex-TPU95-HF_V5.5_2025-12-29_EN.pdf. Accessed October 10, 2026.

[4] Technical Specs (NinjaTek). https://ninjatek.com/support/technical-specs/. Accessed October 10, 2026.

[5] Design of Printing Parameter Settings Methodology for FFF Printing of Waterproof Samples from a Flexible Material (Acta Mechanica Slovaca, 2023). https://actavia.sjf.tuke.sk/artkey/ams-202301-0007_design-of-printing-parameter-settings-methodology-for-fff-printing-of-waterproof-samples-from-a-flexible-materi.php. Accessed October 10, 2026.

[6] Flexible materials (Prusa Knowledge Base). https://help.prusa3d.com/article/flexible-materials_2057. Accessed October 10, 2026.

[7] Watertight 3D printing PT1: Vases, cups and other open models (Prusa Research blog). https://blog.prusa3d.com/watertight-3d-printing-pt1-vases-cups-and-other-open-models_48949/. Accessed October 10, 2026.

[8] Elastollan Material Properties, Thermoplastic Polyurethane Elastomers (BASF). https://basf.com/dam/jcr:b36f0d83-b60b-35d8-8dab-35f7f0795b37/basf/www/kr/documents/ko/product/Elastollan_Material%20Properties.pdf. Accessed October 10, 2026.

[9] Flex TPU S-Flex 98A (Spectrum Filaments). https://shop.spectrumfilaments.com/eng_m_Flex-TPU-_S-Flex-98A-1679.html. Accessed October 10, 2026.

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