Which filament is waterproof? Materials for parts that hold water

Asked 3D Content Team
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Abstract. PLA, PETG, ASA, PP and PC compared for holding water: the perimeter count Prusa needed, data-sheet water absorption, heat limits and outdoor use.

Keywords: watertight, petg, asa, pla

Table 1. The table

Material	Perimeters Prusa needed	Saturated water absorption (data sheet)	Heat limit	Prusa Knowledge Base note
PLA	4	0.43 percent (Bambu Lab PLA Basic, 25 °C, 55 percent RH)	softens over 60 °C	degrades under UV
PETG	4	0.45 percent (Bambu Lab PETG Basic, 25 °C, 55 percent RH)	below 80 °C	most exterior use, water and humidity resistant
ASA	2	0.17 percent after 7 days (Prusament ASA, 24 °C, 22 percent RH)	up to 93 °C	UV resistant, made for outdoors
PP	2	not stated (Fiberlogy)	HDT 51 °C at 0.45 MPa, Vicat 110 °C (Fiberlogy)	chemical resistant, used for fluid containers
PC	2	not stated	not stated	not stated

1 Which filaments are best for parts that hold water?

Any common filament holds water once the walls are thick enough. Prusa Research's leak tests needed only 2 perimeters for PP, PC, ASA and ABS, but 4 for PETG and PLA (polylactic acid). Data sheets put water uptake below half a percent for PLA, PETG and ASA. Heat and sunlight, not water, decide which one lasts.

1.1 The table

Perimeter counts are the minimum at which each material stopped leaking in Prusa's open-model test at 0.15 mm layers. HDT is the heat deflection temperature, where a loaded test bar starts to bend. Absorption figures are at saturation in air at the stated relative humidity (RH), not immersion. PETG is glycol-modified PET, ASA acrylonitrile styrene acrylate, PP polypropylene, PC polycarbonate and ABS acrylonitrile butadiene styrene.

1.2 What the tests showed

Prusa printed vases in eleven materials and counted how many perimeters each needed before the water stayed in. PP, CPE (a co-polyester), PC, ASA and ABS held with 2 walls. TPEE needed 3, PETG, PLA and nylon 4, HIPS and PVB 5. One perimeter in vase mode was enough for every material.

The closed-box test in part 2 changed the order. PLA and carbon-fiber PC boxes stayed dry at 20 m with no coating. Untreated PETG and acetone-smoothed ASA leaked fastest, through the seams. A coat of epoxy made the PETG box fully watertight.

So the material sets the wall count, and the slicer does the rest. The settings are on the watertight guide and the per-material counts on the perimeter page.

1.3 PETG outdoors: waterproof, below 80 °C

Yes for water, with a heat limit. The Prusa Knowledge Base lists PETG as water and humidity resistant and rates it for most exterior use below 80 °C. Bambu Lab's PETG Basic sheet describes the material as resistant to water, UV and temperature and names outdoor accessories as a use. The same sheet lists it as insoluble in water, resistant to most oils and greases, and not resistant to acids or alkalis.

The wall count is the limit. PETG needed 4 perimeters in Prusa's vase test and was the worst untreated material in the closed-box test, so print thick walls or seal the surface.

1.4 PETG or ASA for outdoor parts

ASA when sun and heat matter, PETG when they do not. Prusa rates ASA as UV resistant and good to 93 °C, against 80 °C for PETG, and ASA sealed with 2 perimeters instead of 4. Prusament ASA took up 0.17 percent water in 7 days.

ASA costs more effort to print. Prusa calls it partially hygroscopic and warns of warping, so it needs an enclosure and a

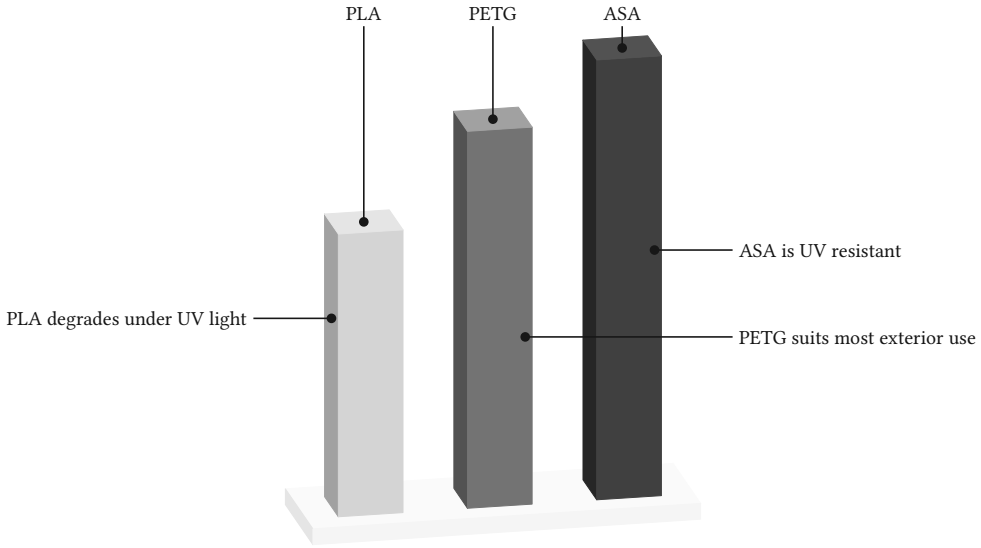


Figure 1. Column heights are each material's heat limit from the Prusa Knowledge Base, drawn to scale; water barely separates the three, but heat and sun do.

260 °C nozzle. Acetone-smoothed ASA also leaked slowly in the closed-box test, so smooth it for looks, not for sealing.

1.5 Polypropylene or PETG for water containers

PP is the container plastic and the harder print. Prusa notes it is used for storage in the food-processing industry and for engine fluid containers, and it sealed with 2 perimeters. Fiberlogy gives a Vicat softening point of 110 °C but an HDT of only 51 °C under load, so it goes soft under weight well before it melts.

Prusa also lists PP's cons: poor adhesion on PEI (polyetherimide) sheets, high warping on large models, and a high price. Prusa does not recommend it for beginners. For a cold-water container printed once, PETG with 4 walls is the easier route. For chemicals or repeated flexing, PP earns the extra trouble.

Whichever material you pick, fill it and check. The leak test takes a night.

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