# Is 3D printed ABS waterproof?

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**Abstract.** Yes, if the layers don't crack: ABS held water with 2 perimeters in Prusa's tests, half what PLA needed. Acetone vapor smooths ABS and ASA, but test it for leaks.

**Keywords:** abs, asa, watertight, waterproofing

**Table 1.** The number

| | ABS | ASA | PLA |
|---|---|---|---|
| Data sheet | Bambu Lab ABS | Prusament ASA | Bambu Lab PLA Basic |
| Water absorption | 0.65 percent at saturation (25 °C, 55 percent RH) | 0.17 percent after 7 days (24 °C, 22 percent RH) | 0.43 percent at saturation (25 °C, 55 percent RH) |
| Minimum perimeters that held water | 2 | 2 | 4 |
| Heat deflection temperature at 0.45 MPa | 87 °C | 93 °C | 57 °C |

## 1 Is 3D printed ABS waterproof?

Yes, as long as the layers stay bonded. ABS (acrylonitrile butadiene styrene) is insoluble in water, and in Prusa Research's leak tests two perimeters held water in ABS, half the four that PLA (polylactic acid) needed. The risk specific to ABS is warping: a layer that cracks away from the one below opens a channel for water.

### 1.1 The number

Absorption and heat figures come from the Bambu Lab ABS and PLA Basic data sheets and the Prusament ASA data sheet. The perimeter counts come from Prusa Research's Watertight 3D printing part 1 tests. RH is relative humidity. Prusa measured ASA at lower humidity over 7 days, so that figure is no like-for-like match for the other two.

### 1.2 Is ABS more waterproof than PLA?

At holding water, yes. At soaking it up, no. ABS sealed with half the walls PLA needed in Prusa's tests. Yet Bambu Lab, testing both under the same conditions, measures 0.65 percent water uptake at saturation for ABS and 0.43 percent for PLA. Both figures are small, and both sheets list the plastic as insoluble in water.

The bigger gap is heat. PLA Basic deflects at 57 °C and ABS at 87 °C, both under a 0.45 MPa load. Warm water that softens a PLA part leaves ABS in shape. The PLA side is on the PLA water container page.

### 1.3 Why ABS prints leak

Mostly through the seam, like any plastic. Prusa found the main leaks came not from the contact between layers but from seams and from the transitions between solid infill and perimeters. Wall counts and the flow settings that close those gaps are on the perimeter page.

ABS adds a failure of its own: it warps. Bambu Lab's sheet says it "warps easily", and the Prusa Knowledge Base puts its shrinkage after cooling at 1 to 2 percent. Layers are its weak direction, with 28 MPa tensile strength across them against 33 MPa along them on Bambu Lab's sheet. A part that pulls as it cools splits there, and the crack runs around the whole wall, past every perimeter.

Both makers prevent it with warm, still air:

- **Enclosure.** Prusa says the printer should sit inside an enclosure with a higher ambient temperature. Bambu Lab lists a 45 to 60 °C chamber for its ABS.
- **No enclosure.** Turn on PrusaSlicer's draft shield. Keep the room ventilated but with no draft across the print.

### 1.4 Is 3D printed ASA waterproof?

Yes, on the same terms as ABS. ASA (acrylonitrile styrene acrylate) also held water with two perimeters in Prusa's tests, and Prusament ASA absorbed 0.17 percent moisture in 7 days. Prusa calls it the successor to ABS: it warps less, smells less, resists UV better and handles heat up to 93 °C.

That makes ASA the outdoor choice. Prusa notes ABS parts used outdoors turn yellowish and more brittle over time. ASA still warps significantly, per Prusa, and wants the same enclosure. How it compares with PETG outdoors is on the waterproof filament page.

### 1.5 Sealing ABS and ASA with acetone vapor

Acetone dissolves the surface of ABS and ASA, and its vapor melts the layer lines into a glossy skin. Prusa names only four materials that smooth with common chemicals: ABS, ASA,

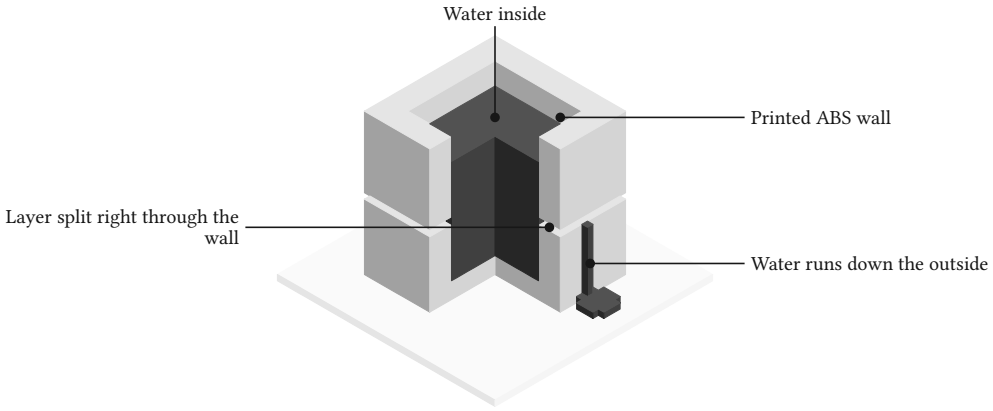



**Figure 1.** A layer that cracks away from the one below opens a gap past every perimeter, and the water inside finds it.

HIPS (high-impact polystyrene) and PVB (polyvinyl butyral). Its Knowledge Base says acetone-smoothed ASA or ABS may skip the slicer changes other materials need to seal. In Prusa's smoothing tests, smoothed models had more than twice the layer adhesion of untreated ones.

Test it anyway. In Prusa's closed-box test, acetone-smoothed ASA leaked slowly. Prusa suspects flaws around the seal, or bubbles from the plastic expanding as it smoothed.

The cold method, which Prusa calls the safest:

1. Put the part in a plastic box with a lid. Prusa uses a transparent polypropylene storage box.
2. Lay paper towels or toilet paper soaked in acetone under and around the part, then close the lid.
3. Take the part out once the layer lines have blurred into a gloss. Large parts can smooth unevenly, with the lower half going further than the top.
4. Let it recover for several hours, or a whole day. The surface stays soft until then, so hold off on any water test.

Prusa also describes a heated version: the box on a heatbed at about 80 °C, about 5 mm of acetone in the bottom, the part on a metal plate 1 to 2 inches above it, for 20 minutes. Prusa says you heat acetone at your own risk. The heater goes outside the box, and the lid must not seal, so pressure cannot build.

Smoothing rounds sharp edges and shifts dimensions. Thin parts can twist until they are unusable.

Acetone itself is the hazard. NIOSH (the US National Institute for Occupational Safety and Health) gives its flash point as 0 °F, so it gives off ignitable vapor at room temperature. It burns in air from a 2.5 percent concentration. Prusa's conditions:

- A well-ventilated area, away from flames and anything flammable.
- Gloves and face protection.
- Never leaving the box unattended.

NIOSH lists eye, nose and throat irritation, headache and dizziness as exposure symptoms.

### 1.6 How to check it on your own print

1. Hold the part up to a light and sight along the layer lines for hairline cracks, above all near the corners.
2. Stand it on a dry paper towel, fill it to the brim, and check the seam after a few minutes and again after several hours.
3. Read the result. A crack along a layer means the print cooled too fast, so enclose the printer. A wet seam points at flow or wall count. A slow sweat through a smoothed part calls for a coating, covered on the epoxy sealing page.

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

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