Printing Guide – Filament PM TPU 96

TPU 96 is a premium flexible filament (thermoplastic polyurethane) with a real hardness of 88 Shore A. The "96" designation in the name comes from the raw material production code; the measured hardness of the printed object according to ISO 48-4:2019 is 88A. The material offers excellent tear resistance (100 N/mm), high elasticity (elongation at break 500%), a softening temperature of 128 °C, and outstanding mechanical durability. It is used for functional flexible parts in B2B and industrial applications – bumpers, seals, flexible couplings, protective covers, silent blocks, vibration dampers, grips, and ergonomic components.

What to expect from this profile – and what not to

Printing flexible materials is significantly different from standard filaments. This profile is the starting point for reliable production of flexible technical parts, but both the material and the printing technology come with specific requirements.

This is not a universal profile for all geometries – the flexible nature of the material causes issues with tall thin walls, long bridges, and complex overhangs. Each part needs to be assessed for suitability with TPU 96, and settings adjusted accordingly.

Expect from this profile: extremely durable, elastic, and tough parts with excellent layer adhesion (100 N/mm tear resistance, 500% elongation), heat resistance up to 128 °C, and chemical resistance.

Do not expect: print speeds comparable to PLA, PETG or ABS. TPU requires significantly slower and more controlled printing, especially for complex geometries. A small boat can easily take an hour to print; a larger functional part may take several hours.

⚠ Golden rules for successful TPU 96 printing ⚠

Before starting your first print, review these rules carefully. Following them determines whether you get a functional flexible part – or a tangled filament under the extruder drive gear.

1. Extruder mechanics are critical (especially Prusa Nextruder)

While Bambu Lab extruders have a fixed drive pressure and short filament path, on Prusa printers with the Nextruder (CORE ONE, XL, MK4S) the correct idler tension is absolutely critical. Too much pressure will flatten the soft TPU and jam it before the heatbreak. Too little pressure leads to drive gear slipping and filament grinding, creating a deformed section that jams under the gear.

Procedure: On a PRUSA 3D printer, loosen the idler tension screw **by a maximum of 1 turn from the neutral position**. The goal is a light but firm grip on the filament. More loosening = slipping; less = compression and jamming. No mechanical adjustment is needed on Bambu Lab printers.

2. Conservative retraction – short, but fast

Long retractions with flexible materials cause certain tangling above the gear – the softened filament is pulled too far up into the cold zone. However, slow retraction is equally problematic: the elastic TPU stretches during retraction and unpredictably springs back on de-retraction.

Procedure: Keep the retraction distance at **0.5–0.8 mm** (or disable it entirely for initial calibration prints – handle stringing manually). Retraction speed **30–35 mm/s**. Slow retraction ≤20 mm/s is counterproductive with flex materials.

3. Reduce accelerations (especially Nextruder)

The default Generic Flex profile in PrusaSlicer has accelerations derived from PETG/PLA settings for Core One – up to 6000 mm/s² for infill. For the Nextruder with 88A filament, this causes large pressure spikes during direction changes, leading to buckling of the soft filament under the drive gear.

Procedure: In the printer profile, reduce accelerations to: default **1000 mm/s²**, outer perimeters **500 mm/s²**, perimeters **800 mm/s²**, infill **1500 mm/s²**, solid infill **1000 mm/s²**, bridges **500 mm/s²**. The Bambu Lab default flex profile is already set more conservatively and usually suffices.

4. Open the top lid of Core One – to prevent heat creep

Heat creep is a documented issue with the Nextruder: if the Core One chamber heats above ~40 °C, the filament softens above the melt zone, creating resistance in the hotend and causing buckling under the gear again. The classic symptom – printing runs fine for 10–30 minutes, then clogs.

Procedure: When printing TPU 96, **open the top lid of the Core One**. A closed chamber is not needed for flex (unlike ASA or PC) – in fact it is detrimental. For the Bambu Lab P1S, printing with the chamber closed makes sense due to the higher overall nozzle temperature.

5. Slow print speed and volumetric limit

TPU must be printed slowly and smoothly. The maximum volumetric flow rate is the main limiting factor – exceeding it leads to under-extrusion and extruder clicking, as the melt cannot pass through the nozzle fast enough.

Procedure: Recommended volumetric flow rate **2.0 mm³/s**. Print speeds: outer perimeters **20 mm/s**, inner perimeters **25 mm/s**, infill **30 mm/s**. Travel speed max **100 mm/s** (faster travel moves cause filament whipping).

6. Dry the filament before every print

TPU is extremely hygroscopic and moisture degrades both extrusion and mechanical properties. Wet TPU pops and crackles during printing, creates surface bubbles, and has noticeably reduced layer bonding. Dry filament is a prerequisite for reliable printing.

Procedure: Before every TPU print, dry the filament at **50–55 °C for 6–8 hours**. Caution – do not exceed 55 °C, as TPU may start sticking to the spool. Printing directly from the dryer during the print is optimal. Store in a sealed container with desiccant.

7. Flow ratio 1.08 (compression compensation)

On the Nextruder, even with light drive gear pressure, the soft TPU is slightly flattened, reducing its effective cross-section. As a result, less plastic reaches the hotend than the profile expects, leading to under-extrusion.

Procedure: In PrusaSlicer, increase the **Flow ratio to 1.08** for Core One. For Bambu Lab P1S, keep the standard value of 1.00.

Which printers is the profile tuned for

The profile is tuned for two platforms. Both deliver reliable results, but differ in setup complexity.

System 1: Bambu Lab P1S / P1P (Bambu Extruder)

The choice for stable, trouble-free flex printing out of the box. The short filament path and fixed drive pressure of the Bambu extruder handle 88A without any mechanical adjustments.

- **Advantages:** fixed drive pressure, short filament path, automatic dynamics calibration allows keeping Flow ratio at the standard value of 1.00.
- **Nozzle:** 0.4 mm standard brass. TPU 96 is not abrasive – a hardened nozzle is not required.
- **Filament:** we recommend feeding from an external spool holder outside the AMS. Although Bambu sells "TPU for AMS", our TPU 96 is not suitable for AMS – it is too soft.
- **Limitations:** the volumetric limit of 3.0 mm³/s must be observed; otherwise the extruder will start skipping.
- **Build plate:** textured PEI sheet. TPU adhesion is good.

System 2: Prusa CORE ONE (Nextruder)

The choice for precise technical parts where dimensional accuracy is the priority. Requires a specific setup before every flex print, but once dialled in, delivers excellent results.

- **Advantages:** excellent extrusion for detailed parts, high dimensional accuracy once properly tuned.
- **Required mechanical adjustments:** loosen the idler by a maximum of 1 turn from neutral, no more – slipping risk.
- **Required software adjustments:** Násobič extruze na 1.08 (kompenzace stlačení), snížené akcelerace (default 6000 → 1500 mm/s² výplň), retrakce 0.5–0.8 mm při rychlosti 30–35 mm/s, otevřít horní víko (proti heat creep).
- **Nozzle:** 0.4 mm standard brass, or 0.6 mm for larger flexible parts with faster printing.
- **Filament:** feed directly from the top of the extruder, with no bends. Spool hanging freely above the printer.
- **Build plate:** satin or textured sheet. TPU adhesion is good.

Key print parameters

The table summarises the key parameters for both profiles. Values are based on the manufacturer's technical data sheet and practical testing. Specific speeds and accelerations can be found directly in the downloaded profile.

Parameter	Value
Nozzle temperature	230–250 °C (start at 245 °C)
Bed temperature	40–60 °C (start at 50 °C)
Filament drying	50–55 °C / 6–8 h
Nozzle	0.4 mm standard brass
Build plate	Satin / textured PEI
Adhesive	not required
Outer perimeter speed	20 mm/s
Inner perimeter speed	25 mm/s
Infill speed	30 mm/s
Travel speed	max 100 mm/s
Max. volumetric flow rate	2.0 – 3.0 mm³/s
Retraction – distance	0.5–0.8 mm

Retraction – speed	30–35 mm/s
Idler (Nextruder) Core One	1 turn loosened from neutral
Filament in AMS	no – external spool holder

Every part deserves fine-tuning

The profile is a reliable starting point, but geometry dictates the final settings. The most common minor adjustments:

- **Tall and thin parts:** the flexible material deflects away from the nozzle. Reduce speed, increase cooling, and consider adding a brim for stability.
- **Overhangs and bridges:** TPU prints poorly across gaps and does not hold its shape. Avoid long bridges and design models with support in mind.
- **Seals and precise dimensions:** print a calibration sample, measure with calipers, and adjust shrinkage compensation. TPU has higher shrinkage than rigid materials.
- **Vibration dampers and silent blocks:** consider reducing infill to 30–50% gyroid for better vibration damping. Full infill unnecessarily adds weight and stiffness.
- **First print of a production run:** always print a test piece and verify functionality (dimensions, flex, durability) before launching the production run.

Summary

TPU 96 from Filament PM is an outstanding flexible material for functional parts. It is not a filament "like any other" – it requires a specific setup, particularly on the Nextruder. Follow the rules below for reliable flexible prints:

- **Idler loosened 1 turn** (Nextruder) – no more, slipping risk.
- **Acceleration at 1500 mm/s² for infill** (Core One) – the default Generic Flex profile is too aggressive.
- **Top lid of Core One open** – to prevent heat creep.
- **Retrakce 0.5–0.8 mm při rychlosti 30–35 mm/s** – short but fast. Slow retraction is worse than none.
- **Drying 50–55 °C / 6–8 h** – TPU is hygroscopic.
- **Flow ratio 1.08 on PRUSA** – compensates for filament compression under the drive gear.
- **Volumetric limit 2–3 mm³/s** – do not increase; leads to under-extrusion.

With our profiles and by following these guidelines, you will get functional flexible parts from TPU 96 – ideal for industrial applications, prototypes, and small production runs.

One final tip: every profile is a living document. If you have experience with specific part types or find a better combination of parameters for your application, let us know. We are always happy to improve our profiles.