Do heat-set inserts work in PETG?

Asked 3D Content Team
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Abstract. Yes: brass heat-set inserts hold in PETG at an iron temperature of about 245 °C, and the part stays rigid to a glass transition near 80 °C. Expect stringing from the tip.

Keywords: heat-set-inserts, petg, threads-and-fasteners

1 Do heat-set inserts work in PETG?

Yes, provided the iron runs about 245 °C (10 to 20 °C above PETG's printing temperature, per CNC Kitchen). Ruthex lists PETG (glycol-modified PET) among the plastics its brass inserts grip. PETG strings and oozes more than PLA (polylactic acid), so expect a thread of plastic on the tip, and stop at 90 % depth before the flat-tool push.

1.1 The number

Table 1. The number

Figure	Value	Source
Iron temperature for PETG	245 °C	CNC Kitchen
Rule behind it	printing temperature + 10 to 20 °C	CNC Kitchen
Ruthex rule	hotend temperature + 10 to 15 °C	Ruthex
Nozzle temperature, PETG	230 °C first layer, 240 °C other layers	Prusa Knowledge Base
Nozzle temperature, Prusament PETG	250 ± 10 °C	Prusament PETG data sheet
Glass transition temperature, PolyLite PETG	81 °C (DSC, 10 °C/min)	Polymaker data sheet
Vicat softening temperature, PolyLite PETG	84 °C	Polymaker data sheet
Heat deflection temperature, Prusament PETG	68 °C at 0.45 MPa and at 1.80 MPa	Prusament PETG data sheet
Service limit for PETG parts	below 80 °C	Prusa Knowledge Base

Iron and nozzle figures from CNC Kitchen, Prusa Research and the Prusament data sheet; thermal figures from the Polymaker and Prusament data sheets. The Prusament sheet does not state a glass transition temperature, only heat deflection. The 81 °C is Polymaker's PETG; other blends will differ by a few degrees. CNC Kitchen publishes no PETG-specific pull-out test; its 181 kg result was measured in PLA.

1.2 Why

PETG is a glycol-modified polyester that prints at 230 to 250 °C, hotter than PLA. The insert rule follows the printing temperature, so the iron goes to about 245 °C. At that heat the brass melts a film of PETG into the knurl, the insert's ridged outer surface, as it does in PLA. Ruthex names PLA, ABS (acrylonitrile butadiene styrene), PP (polypropylene) and PPS (polyphenylene sulfide) alongside PETG as plastics its inserts suit.

The difference is what molten PETG does. The Prusa Knowledge Base calls it prone to stringing and oozing and says it bonds strongly to surfaces. Around an insert, that shows as a thread of plastic that follows the tip up when you lift the iron, and as a sticky fillet over the flange if the iron goes in too far. CNC Kitchen advises melting only about 90 % of the depth with the iron and finishing with a flat tool for every material. In PETG that matters more, because the string attaches to the tip.

The second question is whether the joint survives in service, since an insert only holds while the plastic around it stays rigid. Polymaker's PolyLite PETG lists a glass transition temperature, the point where the polymer turns rubbery, of 81 °C and a Vicat softening point of 84 °C. Prusament PETG lists a heat deflection temperature of 68 °C under load, and the Prusa Knowledge Base gives below 80 °C as the working limit. A PETG boss (the printed column around the hole) holds an insert in a warm enclosure, not next to a heated bed at 90 °C.

CNC Kitchen warns against reusing an insert pulled from a PLA part in PETG: the PLA residue in the knurl weakens the new joint.

Get it wrong, usually by running the iron too hot or too deep, and PETG floods the thread. The screw binds in a plug of plastic, the insert spins in its seat, and the boss whitens.

1.3 How to check it on your own print

1. Set the iron to your PETG's printing temperature plus 10 to 20 °C, about 245 °C for a 230 °C filament. Fit a dedicated insert tip if you have one.
2. Sink the insert under the iron's weight to about 90 % depth, then lift the iron straight up and watch for a string; pinch it off before it lands in the bore.
3. Press the insert flush with a flat tool and hold it for a few seconds while the PETG sets.

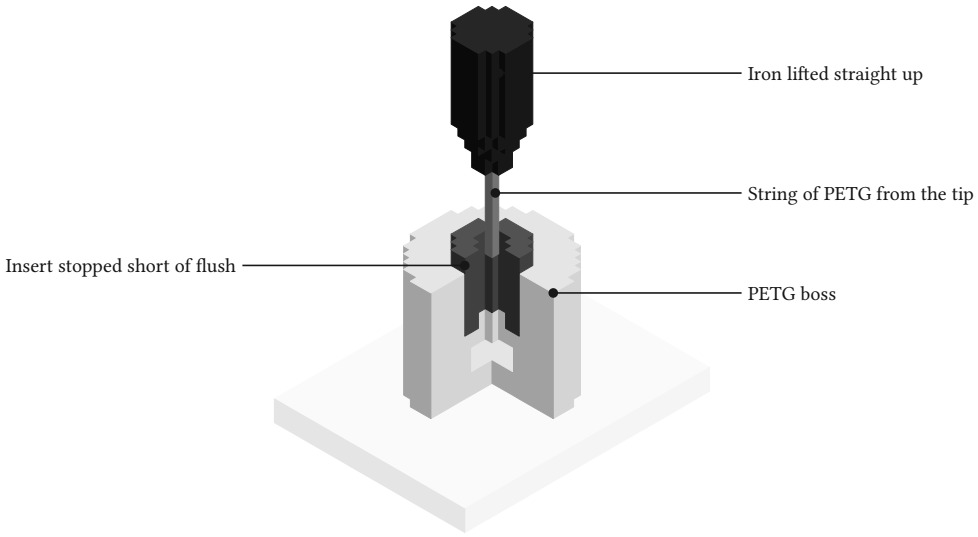


Figure 1. The insert stops a little short of flush, and as the iron lifts a thread of molten PETG follows the tip up from the bore.

4. After it cools, thread a screw in by hand. It should start without resistance; if it binds, plastic has reached the thread and the temperature or depth was too high.
5. If the part will see heat, warm it to its service temperature and torque the screw again. A boss that stays rigid below 80 °C is doing what the data sheets say.

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