How to join two 3D printed parts

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Abstract. CA glue for PLA, PETG, ABS and nylon, acetone for ABS and ASA, epoxy for mixed plastics, a primer for PP, and 0.15 to 0.5 mm clearances for pins, dovetails and clips.

Keywords: replacement-parts, home-repair, part-strength, heat-set-inserts

Table 1. Which glue works on which 3D printed plastic

Material pair	Adhesive or method	Surface prep	Handling and full cure	Source
PLA to PLA	CA super glue	Sand the faces flat, remove the dust	Grabs in seconds; maximum hardness after 8 to 24 h	Prusa Research
PETG to PETG	CA super glue; no hobby solvent softens PETG	Sand flat, remove the dust	As PLA	Prusa Research
ABS to ABS, ASA to ASA	Acetone solvent weld	Smooth, level faces so the solvent spreads evenly	Many days on large prints	Prusa Research
ABS to ABS	CA super glue	Wipe with isopropyl alcohol (IPA); remove excess glue at once	Fixtures in under 5 s; full strength 24 to 72 h	Loctite 401 TDS, Henkel bonding guide
Nylon (PA) to nylon	CA super glue; a primer adds nothing	IPA wipe	Full strength 24 to 72 h	Henkel bonding guide, Loctite 401 TDS
Polypropylene (PP) or polyethylene (PE)	CA over a polyolefin primer, or a polyolefin acrylic (e.g. 3M DP8010 Blue)	IPA wipe	DP8010: handling 60 min, full cure 24 h at 23 °C (73 °F)	Henkel bonding guide, 3M TDS
Mixed rigid plastics, e.g. PLA to PETG or ABS	Two-part epoxy (e.g. Loctite Epoxy Plastic)	Clean, dry, roughen smooth faces	Support 10 min, usable after 1 h, full cure 24 h	Loctite Epoxy Plastic TDS
PLA to PLA, ABS to ABS, no glue	Friction weld with a stick of the same filament spun in a rotary tool	Clean faces	Solid once it cools	Scorch Works

1 How do you join two 3D printed parts?

Match the method to the plastic, or use a mechanical joint. Cyanoacrylate (CA) super glue bonds PLA, PETG, ABS and ASA; acetone solvent-welds ABS and ASA but not PETG; two-part epoxy joins mixed materials; polypropylene needs a primer or a polyolefin adhesive. For parts that must come apart, use screws in heat-set inserts.

1.1 Which glue works on which 3D printed plastic

Figures from Prusa Research's gluing guide, Henkel's technical data sheets (TDS) for Loctite 401 and Epoxy Plastic, its Design Guide for Bonding Plastics and 3M's DP8010 Blue TDS. Cure times vary by product, so check your glue's label.

1.2 Why the glue has to match the plastic

A solvent weld dissolves both faces so the plastic flows together. Prusa Research's guide lists acetone for ABS and ASA and states that PETG "is inert to all chemicals normally available to a hobbyist." For PETG, the choice is CA or epoxy.

CA came out strongest in Prusa's quick tensile test, one sample per glue. Peckalep Medium, the CA Prusa uses daily, held 10.2 MPa on PLA and 12.6 MPa on PETG. Two epoxies reached 3.7 to 6.3 MPa on the same materials. In Henkel's tests, molded ABS broke before a Loctite 401 joint did, and 401 joints on molded nylon 6 typically exceeded 4,000 psi.

Polypropylene is the exception. In Henkel's tests every adhesive performed poorly on unprimed PP except primed CA and polyolefin adhesives. Loctite Epoxy Plastic's data sheet rules out polyethylene, polypropylene and nylon. For TPU, Prusa says CA works as long as the mating surfaces are at least a bit stiff.

Heat also weakens glue. Prusa reports regular CA keeps about 50 percent of its strength at 80 °C (176 °F) and 20 percent at 100 °C (212 °F). Loctite Epoxy Plastic's long-term service limit is 120 °F (49 °C).

A glued seam behaves like another layer line. Prusa's best PETG joint broke at 13.1 MPa, while Bambu Lab lists 51 MPa for printed PETG Basic along the layers (XY). The two tests differ, but the gap is large.

1.3 How to glue the joint

1. Dry-fit the parts. Sand the mating faces flat and remove dust, grease and old glue. Henkel and 3M both list an IPA wipe for plastics.

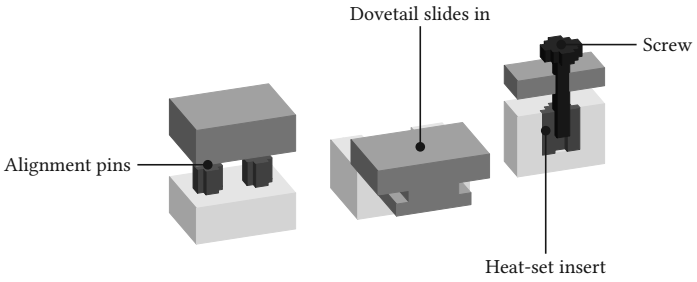


Figure 1. Pins locate two halves, a dovetail slides together, and a screw in a heat-set insert lets the part come apart and go back together.

2. **CA:** coat one face thinly, press the parts together and hold them until the glue fixtures. Henkel's sheet says thin bond lines cure fastest and wide gaps slow the cure, so fill gaps with epoxy instead. An activator speeds CA up, but Prusa warns its heat can deform PLA, and Henkel says it can lower final strength.
3. **Acetone (ABS, ASA):** wet both faces, press them together and clamp. Spilled acetone leaves marks on the surface.
4. **Epoxy:** mix equal parts for about a minute and coat both faces within one or two minutes. Support the joint for 10 minutes and wipe off excess before it sets.
5. Load the part only after full cure: 24 to 72 hours for Loctite 401, per Henkel.

Ventilate. Fisher Scientific's acetone safety data sheet (SDS) warns that the vapor may cause drowsiness or dizziness and gives a flash point of -20 °C (-4 °F). Use acetone outdoors or in a well-ventilated area, away from flames. Henkel's super glue SDS warns of respiratory irritation. Prusa adds that CA can react with cotton or wool hard enough to smoke.

1.4 Mechanical ways to connect 3D printed parts

Use a mechanical joint when the part must come apart or takes more load than a glued seam can carry.

Table 2. Mechanical ways to connect 3D printed parts

Joint	Clearance between parts	Source
Alignment pin or dowel in a hole	0.15 to 0.20 mm (snug, locating)	Marston Makerspace, University of Florida
Dovetail or sliding tab	0.20 to 0.25 mm (sliding)	Marston Makerspace, University of Florida
Snap-fit clip	0.5 mm around the moving arm	Protolabs Network

- **Screws in heat-set inserts** give threads that survive repeated assembly. Hole sizes and installation are in the heat-set inserts guide.
- **Alignment pins** also help glued joints: they locate the halves so a fast-grabbing CA cannot set crooked.
- **Snap fits** need a tapered arm and the right orientation, as covered in snap-fit clips.

Print a tolerance test before the real part, as described in matching tolerances.

1.5 How to fix a broken 3D printed part

- **Clean snap, both halves intact, light load:** CA on PLA, PETG or nylon; acetone or CA on ABS and ASA.
- **Split along a layer line:** glue it, then bridge the crack with a friction-welded bead or a layer of epoxy. The split marks a weak layer bond, so under load the crack tends to reopen.
- **Chunk missing or gappy fit:** epoxy, which Henkel's sheet describes as a gap filler that can be sanded and drilled.
- **Stripped screw hole:** drill it out and fit a heat-set insert.
- **Load-bearing part:** reprint it rather than glue it, turned so the load runs along the layers. Bambu Lab's PETG Basic pulls 51 MPa in XY against 35 MPa across the layers (Z), and print orientation for strong parts shows how to place it. Never print or glue car brake, steering, suspension, seat-belt, airbag, fuel-system or wheel parts.

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