3D Printing Troubleshooting Guide

Common Problems and Solutions

3D Print Calculator | www.3dprintcalculator.co.uk

Quick Diagnostic Checklist

Before troubleshooting, check these basics:

- ✓ Bed is level
- ✓ Nozzle is clean and not clogged
- ✓ Filament is loaded correctly
- ✓ Temperature settings are correct for your material
- ✓ Filament is dry (not moist)
- ✓ Printer is on stable surface
- ✓ All screws and belts are tight

Layer Adhesion Issues

Problem: Layers Not Sticking Together

Symptoms: Prints break easily along layer lines, weak parts, delamination

Solutions:

1. **Increase Nozzle Temperature:** Raise by 5-10°C to improve layer bonding
2. **Reduce Layer Height:** Thinner layers bond better (try 0.15-0.2mm)
3. **Slow Down Print Speed:** Slower speeds allow better layer adhesion
4. **Increase Flow Rate:** Slight over-extrusion (105-110%) improves bonding
5. **Check for Drafts:** Use enclosure or block air currents
6. **Dry Filament:** Moist filament causes poor layer adhesion

💡 **Tip:** For ABS and PETG, an enclosure is essential for good layer adhesion. PLA can print without one but benefits from stable temperatures.

Warping & Bed Adhesion

Problem: Print Warping/Lifting from Bed

Symptoms: Corners lifting, print detaching mid-print, warped bottom layer

Solutions:

1. **Increase Bed Temperature:** Higher bed temp improves adhesion
2. **Use Brim or Raft:** Adds surface area for better adhesion
3. **Level Bed Properly:** First layer must be correct distance
4. **Use Adhesion Aids:** Hairspray, glue stick, or PEI sheet
5. **Enclosure:** Prevents cooling too quickly (essential for ABS)
6. **Clean Bed:** Remove oils and residue
7. **Increase First Layer Height:** 0.3mm first layer improves adhesion
8. **Slow First Layer:** Print first layer at 20 mm/s

Material	Bed Temperature	Adhesion Aid
PLA	50-60°C	Optional (hairspray)
PETG	70-80°C	Recommended (glue stick)
ABS	90-100°C	Essential (ABS slurry)
TPU	50-60°C	Optional

Stringing & Oozing

Problem: Stringing Between Parts

Symptoms: Thin strings of plastic between separate parts, "hairy" prints

Solutions:

1. **Increase Retraction Distance:** More retraction pulls filament back
2. **Increase Retraction Speed:** Faster retraction reduces oozing
3. **Lower Nozzle Temperature:** Reduce by 5-10°C
4. **Enable Coasting:** Stops extrusion before end of line
5. **Increase Travel Speed:** Faster moves reduce stringing
6. **Enable Wipe:** Wipes nozzle during travel moves
7. **Dry Filament:** Moist filament causes more stringing

💡 **Retraction Settings by Extruder Type:**
Direct Drive: 1-3mm retraction at 40-50 mm/s
Bowden: 5-7mm retraction at 40-60 mm/s

Under-Extrusion

Problem: Not Enough Filament Coming Out

Symptoms: Gaps in layers, thin walls, weak prints, missing layers

Solutions:

1. **Check Nozzle Clog:** Clean or replace nozzle
2. **Increase Flow Rate:** Raise to 105-110%
3. **Check Filament Diameter:** Measure actual diameter and update slicer
4. **Increase Temperature:** Higher temp improves flow
5. **Check Extruder:** Ensure gear is gripping filament properly
6. **Check Bowden Tube:** Ensure no gaps or blockages
7. **Increase Line Width:** Slightly wider lines compensate for under-extrusion
8. **Check Filament Path:** Ensure smooth, unobstructed path

⚠ **Common Causes:** Clogged nozzle (most common), incorrect filament diameter setting, worn extruder gear, too low temperature, partial blockage in hotend.

Over-Extrusion

Problem: Too Much Filament Coming Out

Symptoms: Bulging layers, elephants foot, rough surface, dimensional inaccuracy

Solutions:

1. **Decrease Flow Rate:** Reduce to 90-95%
2. **Calibrate E-Steps:** Ensure extruder is calibrated correctly
3. **Check Filament Diameter:** Update if incorrect
4. **Reduce Line Width:** Slightly narrower lines
5. **Lower Temperature:** Reduce by 5-10°C
6. **Check Nozzle Size:** Ensure slicer matches actual nozzle

💡 **Calibration Test:** Mark 100mm of filament, extrude 100mm, measure actual extrusion. Adjust E-steps: New Steps = (Old Steps × 100) / Actual Extruded Length

Layer Shifting

Problem: Layers Misaligned or Shifted

Symptoms: Print appears to "jump" mid-layer, layers not aligned

Solutions:

1. **Tighten Belts:** Loose belts cause shifting
2. **Check Pulleys:** Ensure set screws are tight
3. **Reduce Print Speed:** Too fast can cause missed steps
4. **Check Stepper Motors:** Ensure they're not overheating
5. **Check for Obstructions:** Nothing blocking movement
6. **Reduce Acceleration:** Lower acceleration settings
7. **Check Power Supply:** Insufficient power causes missed steps
8. **Lubricate Rails:** Smooth movement reduces resistance

⚠ **Warning:** Layer shifting is usually mechanical. Check all moving parts for proper tension and alignment.

Poor First Layer

Problem: First Layer Issues

Symptoms: First layer not sticking, gaps, too thin/thick, rough surface

Solutions:

1. **Level Bed:** Most common issue - bed must be perfectly level
2. **Set Correct Z-Offset:** Nozzle distance from bed is critical
3. **Increase First Layer Height:** Use 0.3mm for better adhesion
4. **Slow First Layer Speed:** Print at 20 mm/s
5. **Increase First Layer Temperature:** 5-10°C hotter than normal
6. **Increase First Layer Flow:** 110-120% for better squish
7. **Clean Bed:** Remove all residue
8. **Use Adhesion Aid:** Hairspray or glue stick

💡 **First Layer Test:** Print a single-layer square. It should be smooth, flat, and well-adhered. Adjust Z-offset until perfect.

Overhangs & Bridges

Problem: Poor Overhangs & Bridges

Symptoms: Sagging, drooping, failed overhangs, messy bridges

Solutions:

1. **Increase Cooling:** Maximum fan speed for overhangs
2. **Reduce Layer Height:** Thinner layers handle overhangs better
3. **Slow Down Print Speed:** Especially for overhang areas
4. **Lower Temperature:** Cooler filament sags less
5. **Add Supports:** For angles >45°
6. **Enable Support Interface:** Better support removal
7. **Orient Part:** Minimize overhangs in design
8. **Use Bridging Settings:** Slower speed, more cooling

Overhang Angle	Action
0-30°	No support needed
30-45°	May need support, try without first
45-60°	Support recommended
60-90°	Support essential

Nozzle Clogging

Problem: Nozzle Clogged

Symptoms: No filament coming out, under-extrusion, clicking extruder

Solutions:

1. **Cold Pull (Atomic Pull):** Heat to 230°C, cool to 90°C, pull filament
2. **Needle Clean:** Use 0.4mm needle to clear blockage
3. **Heat and Push:** Heat nozzle, manually push filament through
4. **Replace Nozzle:** If severely clogged, replace
5. **Check for Debris:** Remove any foreign material
6. **Clean Hotend:** Disassemble and clean if necessary

⚠ **Prevention:** Use quality filament, keep nozzle clean, avoid temperature too low, use filament filter/dust filter.

Z-Wobble & Banding

Problem: Horizontal Lines/Banding

Symptoms: Visible horizontal lines, inconsistent layer heights, wavy surface

Solutions:

1. **Check Z-Axis Rod:** Ensure straight and clean
2. **Lubricate Z-Axis:** Smooth movement reduces wobble
3. **Check Z-Axis Coupling:** Ensure tight connection
4. **Reduce Layer Height:** Smaller increments reduce visibility
5. **Check Frame Stability:** Ensure printer frame is rigid
6. **Enable Linear Advance:** Improves layer consistency
7. **Check Stepper Motor:** Ensure smooth operation

Material-Specific Issues

PLA Issues

Problem	Solution
Brittle prints	Increase temperature, reduce cooling, dry filament
Stringing	Increase retraction, reduce temperature
Poor overhangs	Increase cooling fan, reduce temperature

ABS Issues

Problem	Solution
Warping	Use enclosure, increase bed temp, use brim
Layer separation	Increase temperature, use enclosure, reduce cooling
Cracking	Increase temperature, use enclosure, avoid drafts

PETG Issues

Problem	Solution
Stringing	Increase retraction, reduce temperature, dry filament
Bed adhesion too strong	Use release agent, reduce bed temp, use PEI sheet
Blobs/zits	Enable coasting, adjust retraction, reduce temperature

TPU Issues

Problem	Solution
Not extruding	Use direct drive, reduce retraction, increase temperature
Stringing	Minimal retraction, slow speed, reduce temperature
Poor layer adhesion	Increase temperature, slow speed, reduce cooling

Quick Reference: Problem → Solution

Problem	Primary Solution	Secondary Solution
Warping	Increase bed temp	Use enclosure, add brim
Stringing	Increase retraction	Reduce temperature
Layer separation	Increase temperature	Reduce layer height
Under-extrusion	Check nozzle clog	Increase flow rate
Over-extrusion	Reduce flow rate	Calibrate E-steps
Poor first layer	Level bed	Adjust Z-offset
Layer shifting	Tighten belts	Reduce speed
Poor overhangs	Increase cooling	Reduce temperature

Maintenance Schedule

- **Daily:** Clean bed, check first layer
- **Weekly:** Clean nozzle, check belts, lubricate rails
- **Monthly:** Full calibration, check all screws, clean hotend
- **As Needed:** Replace nozzle, replace PTFE tube, replace belts