



3D PLATFORM TRAINING INSTRUCTION

PRINTING THE TOP LAYER BOX

3DPTI-0005

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APPROVALS			
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APPLICABLE MODELS	
Legacy	Work Series
<input checked="" type="checkbox"/> X1000	<input checked="" type="checkbox"/> 100
<input checked="" type="checkbox"/> X1000 CE	<input checked="" type="checkbox"/> 200
<input checked="" type="checkbox"/> WorkBench	<input checked="" type="checkbox"/> 300
	<input checked="" type="checkbox"/> 400

CONTROL STATUS
<input type="checkbox"/> Confidential
<input type="checkbox"/> Internal use only
<input checked="" type="checkbox"/> Uncontrolled

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Introduction & Purpose

The top layer box is designed to test the dimensional accuracy of the print, and illustrate the importance of the top layer. Ensuring dimensional accuracy and consistent top layers is critical for high quality prints.

This training instruction will instruct and prepare the user to successfully validate the top layer of a print and to identify and correct common issues.

Tools & Materials

- Knife or razor scraper to remove completed prints.
- Calipers or micrometer.
- Print material (PLA material is recommended for calibration prints).
- Solid box gcode file
- SD card or network connection to the web interface (WorkSeries and later) to load print files.

Process

Printing the part

Prepare the printer

1. Prepare print bed. Clean the print area and apply adhesion agent if used.
2. Load material. Load print material and ensure extruder is extruding material properly.

Prepare the part

1. Prepare gcode file. Use supplied gcode if available. If using alternate nozzle sizes, slice the file using just a single perimeter and bottom layer, no infill.
2. Load file using SD card or web interface.

Start print

Print the gcode file and observe during the print. Ask these questions during the print.

- Are the outer perimeters bonding during the print?
- Are the top layers covering over the infill properly?

When the part completes, wait for print bed to cool down and then remove it, being careful not to damage the part. Removing a part when warm can warp the part and potentially affect measurements.

Inspecting the part

Visual inspection:

Look at the solid box after removal. There are visual clues to indicate whether the box is printing correctly. There are a few possibilities

1. **Too few top layers:** May be small holes around the edges of the top of the part. May have bumps or raised portions on the top surface rather than a smooth top surface. Gaps in the rows of material may occur. This is generally due to the beads of material sagging between lines of infill.



2. **Too little extrusion:** Inconsistent material extrusion. Layers and rows of extruded material can be skipped and produce an undesirable top layer finish.



3. **Sufficient top layers & extrusion:** Top surface will be flat and smooth. No gaps, bulges, or holes in the top surface of part.

Tool inspection:

1. Use a set of calipers or a micrometer to measure the outer dimensions of the box, Desired measurement in XY is 40mm +/- .2mm (Due to material shrink after printing in the XY plane, measurements of 39.8 are normal for a 40mm box).

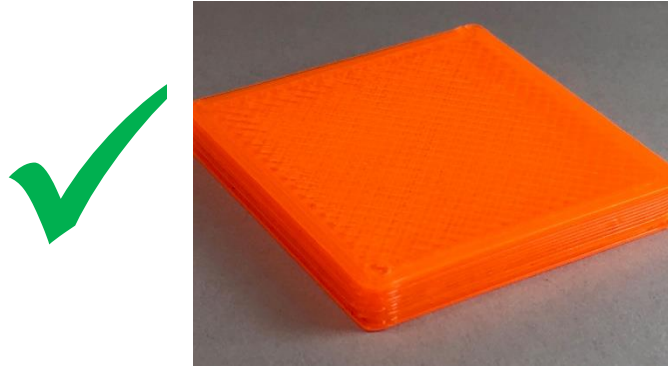
Correcting the part

Corrections will depend on what is found during inspection.

1. **Too few top layers.** In the slicing software, increase the number of top layers and/or increase infill percentage
2. **Too little extrusion.** In the slicing software or on the machine control, increase extrusion in increments of 5% at a time until top layers are consistent. Check filament diameter and temperature to ensure they are sufficient for part.

3. **Part is dimensionally inaccurate.** It is normal for the solid box print to be less than 40mm due to material shrink. If the OD measurement is significantly less than 39.8, check the input file to ensure it is the proper size.

If corrections are made to the prints or machine settings, the solid box print process must be repeated and the new part inspected.



Wrapping up

Solid box print is complete when boxes from all nozzles adhere to bed properly, pass visual inspection, and measure within .2mm of nominal size.

Conclusion

The solid box is a simple but powerful tool to validate extrusion and top layer settings. This print demonstrates the importance of the top layer and provides a foundation for print process setting changes.