The Recreator 3D
Operations Manual

Designed and Built By:
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- With Design Contributions from Nick Jones and Ross Conley.
- Contributions from Ross Newkirk, Melissa Savides, Yvette and Allen Taylor, XVICO and Kassie Ma.

Thank You to Everyone who made The Recreator 3D Possible!

RECREATOR3D.COM - RECYCLE.XYZ - JRT3D.COM - 2021
https://www.facebook.com/groups/recreator3d

Inspired by The Online DIY PET Pultrusion Community and The Need of Recycling Properly for our Future Production Needs!

TOOLS NEEDED :

$7.99 - **https://amzn.to/3GXTi7z -** **6 Inch Needle Nose Pliers**		
$6.89 - **https://amzn.to/309wL74 -** **Micro Cutter Flush Cutter Soft Wire Cutter**		
$11.09 - **https://amzn.to/3EURjPh -** **Digital Caliper, Adoric 0-6" Calipers Measuring Tool**		
$6.99 - **https://amzn.to/3qcKGnw -** **Cut Resistant Gloves**		

$8.08 - **https://amzn.to/3mS9Be0 -** **DEWALT DPG94-1C Dominator SAFETY Glasses, Clear Lens**		
$7.96 - **https://amzn.to/3GY3qx7 -** **Cut Resistant Gloves**		
$10.92 - **https://amzn.to/3CZzxKp -** **Precision Scissors, Small**		
$11.80 - **https://amzn.to/3EW9m7V -** **Goo Gone Pro Power Adhesive Remover**		

$5.89 - **https://amzn.to/3o9MiMg -** **Derma-Plane Razor**		
$37.77 - **https://amzn.to/3EXIm7P -** **Variable Temp Heat Gun**		
$1.00 - **https://www.dollartree.com/jot-retractable-card-holders-4125x1375-in/307646 -** Jot Retractable Card Holders		

General Information Before Starting

MK3Lite uses a single motor and can pull upwards to 300-400mm, with 300mm being the suggested pull speed. With hot end temps 195-210C degrees. 200C degrees is needed in order for the printer to run the gcode commands.

MK3Pro uses dual motors and can pull upwards to 300-600mm, with 300mm being the suggested pull speed and is suggested for more industrial experimental graded plastics beyond soda bottles. With hot end temps 195-210C degrees. 200C degrees is needed in order for the printer to run the gcode commands.

Going Above 600mm in speed with temps higher than 210C are not suggested as you can start to see degradation in the filament quality. 195-210C with 300-400mm are the comfortable ranges for the two machines, with 300mm @ 210C being the suggested pull speed and temperature.

While loading the filament with a pair of pliers; if you struggle to pull the filament through the nozzle manually, the filament is likely cut too wide based on the bottle's thickness. There should be some force needed to pull the filament - but you shouldn't struggle. The strip should glide through with a good amount of forward pull.

If you experience skipping or binding in your pull, the bottle thickness may be thicker than you think. Turning the bottle cutter's size adjustment with a flat head screwdriver; try reducing the size of the width to the next lowest size, this should allow for better pull. For example, if a bottle is .30 thickness it can be cut at a 8mm width...this should be able to be pulled at 300mm @ 210C on both MK3Lite and MK3Pro. If you experience skipping, consider measuring the thickness of your bottle again or simply going to the next lowest size. Not all bottles are created the same.

If still experiencing binding, reduce the pull speed to the next lowest speed. This should reduce the skipping. If still experiencing either skipping or binding, double check you've reduced the strips width. You can also make sure your spool rod nuts are not fully locked. A little loose is better than super tight.

If you find the bottle is making a rough sandpaper textured filament, Speeds may be excessive. Try slowing down the speeds. You may also try to use the bottle cutter guide and twist the filament, placing the guide into it's locking slot. This should help add some tension in the pull and relieve this roughness.

Each spooling command is long enough for a 2L bottle. You will see the strip getting smaller towards the neck of the soda bottle and this is a good time to cut the bottle from the pull. Cut toward the back of the unit and let the puller continue the pull. Be very careful at this point. The filament will come out from the nozzle and will whurl around in a circle. It's suggested to have on safety glasses for this step, as well to keep your face away from your unit while unloading the filament. You can hold onto the filament as it's coming through on this step and that will reduce the spool unwinding by itself. Protecting your face and eyes is the most crucial part of this step. Safety first!

Standard 2L soda bottles work especially well letting The Recreator 3D Do the pulling for you. Not all PET#1 bottles will work - so experimenting is crucial. If you find the filament you are trying to pull is too much for the unit; with all ratios in proper order, you can cut the strips by hand and load the unit without a loaded bottle. This is suggested for other PET materials not in the form of bottles. It should help with binding and allow for an easier pull.

Please submit your findings to the master index of easily converted plastics. The unit can also be used to manually pull PET strips and then load them into the pultruder sans the cutter strip during the conversion process.

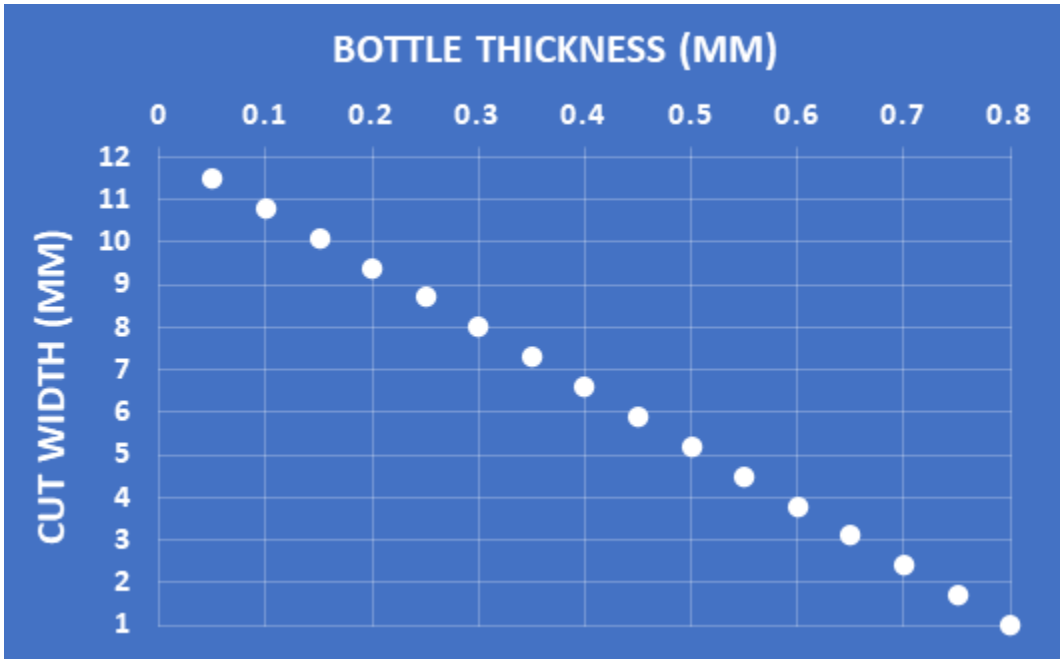
Preparing for Extrusion

1. Clean and wash your bottle of all labels and glue. The bottles must be fully clean and dry from water and other cleaning solutions. To remove labels; soak the bottles in hot water, and peel them off. Try not to use a knife to cut the bottles, as this may damage your bottles. Apply vegetable oil or Goo Gone to the glue. Scrub it off and wash with soapy water. Rinse thoroughly with water and dry.

2. This Step Is optional and not necessary, but can gain a few extra grams per bottle. To smooth out the bottle (if the bottle has curves or you want a rounded bottom), use a heat gun and a drill. Connect the bottle to the drill (using a bolt attached to it's cap) and rotate it over a heat gun (with a little water inside the bottle) to smooth out any ruffles or bumps in the bottle.

3. Cut off the bottom of the bottle and finish drying if needed. Cut off a small strip and use a pair of calipers to measure the thickness of the bottle. Refer to the "Bottle Thickness to Cut Width" conversion chart to determine these ratios. To keep things moving efficiently, It's suggested to group your bottles together by brand and type to avoid needing to change the cutter's thickness constantly. Change the bottle cutter height as needed using a flathead screwdriver.

Bottle Thickness to Cut Width Conversion Chart



Bottle thickness 0.20 mm --- width 10 mm --- Filament diameter 1.6

Bottle thickness 0.25 mm --- width 09 mm --- Filament diameter 1.6

Bottle thickness 0.30 mm --- width 08 mm --- Filament diameter 1.6

Bottle thickness 0.35 mm --- width 07 mm --- Filament diameter 1.6

Bottle thickness 0.40 mm --- width 06 mm --- Filament diameter 1.6

Bottle thickness 0.45 mm --- width 05 mm --- Filament diameter 1.6

Operating The Recreator 3D

1. Cut a small strip along the bottle. Insert the bottle rod into the cutter base. Drop the bottle onto the rod and start to rotate the bottle through the cutter to start the strip. Make sure the bottle is sitting on top of the bearings. Attach the bottle weight to the top and attach the keyfob tensioner from the weight to the base of the cutter. Pull about 10 inches or so to work with.

2. Power on the unit. Cut the strip into a thread. About 1/16th of a 2 inch length. Thread the strip through the 1.60mm nozzle by hand. Try your best to keep the end centered in the hole, so that it can fit through the nozzle on the opposite end. Once you get it through the nozzle, use pliers to grab the end of the plastic. DO NOT use your hands to pull the filament. It's very easy to harm yourself doing this.

3. Continue to grip the ribbon on the nozzle side with a pair of pliers. Set the heat to approximately 200°C, and wait before proceeding. Be mindful the temps will rise and the strip will deform, at this point it can pull itself backwards due to warping. You should slowly start to pull the filament forward as temps get around 140C. At 180C is where the filament should start to easily be pulled through the nozzle. 195C is suggested lowest temps. Bring the temps to 200C, as the unit won't run until this temperature is hit 200C.

4. Once heated, attempt to pull the filament through the heating block with a pair of pliers. This may take a bit of force. If you find that you are exerting a lot of force in order to do this, you may need to wait for it to heat up a while longer or double check your bottle's cut width vs it's thickness.

5. Continue to pull the filament with the pliers in an even; smooth motion, until you have approximately 14 inches of filament extruded. You can either noose your filament with a draw string or continue to pull enough to noose into the spooler. Lock the filament into place with a spacer that is either printed or taken from your wheels.

6. Slowly move your spooler towards the right to tension the filament onto the spool intiaitally. Once this is done, you can start up the stepper motor. On your SD Card should be your travel commands. Based on your bottle loaded, determine what speed is best and load that gcode command. Run the 300mm gcode from the SD Card to start the pultrusion process. This is the standard suggested speed for both MK3Lite and MK3Pro.

7. Continue until all the ribbon has been extruded. Running the gcode should finish a 2L bottle. If not, make sure temps are still active and manually extrude an additional length after cutting the strip. At the end; the filament may spring forward, so it is best to stay back from the machine until it is completely stopped. Consider wearing safety glasses for the end step as well as holding the filament as it comes out of the nozzle and onto the spooler on the final stretch.

8. Turn the temperature 0 or power down the unit and untie your filament from the spool. You will have to manually remove and spool up your filament.

9. The process is complete! Your filament is ready to use.

Preparing Your Printer To work With the Pultruded Filament

We've included this to easily guide you along in your first time use of this experimental filament.

This filament is actually similar to a straw, with a hollow inside. The outer diameter is formed through the nozzle (any size can be drilled), ours is around 1.60mm. With the expansion of this material as well the nature of it being hollow…this diameter can be within an "ish" variant. We've seen numbers between 1.58-1.66mm.

With the above in mind; we've found increasing our favorite slicer's flow rate to 150% (1.10) has allowed us to bypass this variant. You may also experiment changing your filament diameter to 1.60mm.

Please use the filament wisely. We suggest the smaller amounts be used first among your initial calibrations. Once you're happy with your settings, try something with the larger amounts.

We've found that this filament needs to be cooled, with no cooling the filament can transition to a harder density.

If you find your filament is not properly bonding – You can increase your flow rates within your slicer. We've found using the following slicer settings has allowed us to print successfully. If you find this not to be the case, please reach out to us via our Facebook group account. We'd also love to know about what settings worked for you and what you printed, please join the group and share your finished prints!

Filament from soda bottles suggested slicer settings using CURA 4.8 and Ender 3 clone with direct drive and dual parts cooling:

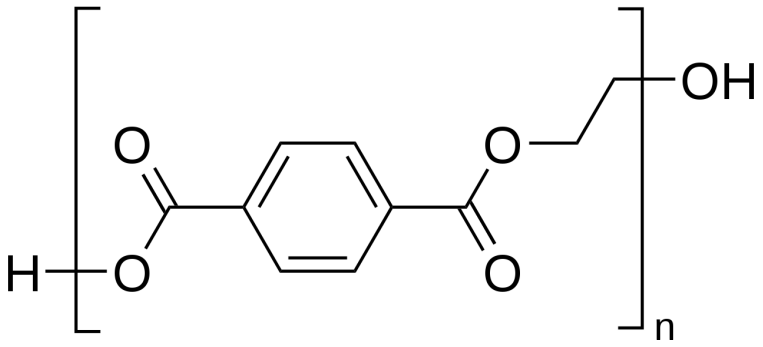
- **Layer Height.....0.2mm**
- **Nozzle Temp.....255**
- **Bed Temp.....75**
- **Flow.....150%**
- **Initial Layer Flow.....160%**
- **Print Speed 30mm**
- **Fan.....20%**
- **Retraction.....4.5mm**
- **Retraction Speed…....40mm**

STL: https://www.thingiverse.com/thing:763622

Slicer Profiles can be found in the Files Section of the Facebook Group:

https://www.facebook.com/groups/recreator3d/files/

Polyethylene terephthalate



Polyethylene terephthalate, is the most common thermoplastic polymer resin of the polyester family and is used in fibres for clothing, containers for liquids and foods, and thermoforming for manufacturing, and in combination with glass fibre for engineering resins. Wikipedia

Melting point: 500°F (260°C)

Formula: (C10H8O4)n

Density: 1.38 g/cm³

IUPAC ID: Poly(ethyl benzene-1,4-dicarboxylate)

Boiling point: 350 °C (662 °F; 623 K) (decomposes)

Molar mass: 10–50 kg/mol, variesAbbreviations: PET, PETE

https://en.wikipedia.org/wiki/Polyethylene_terephthalate

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