DIY 3D Printing Filament

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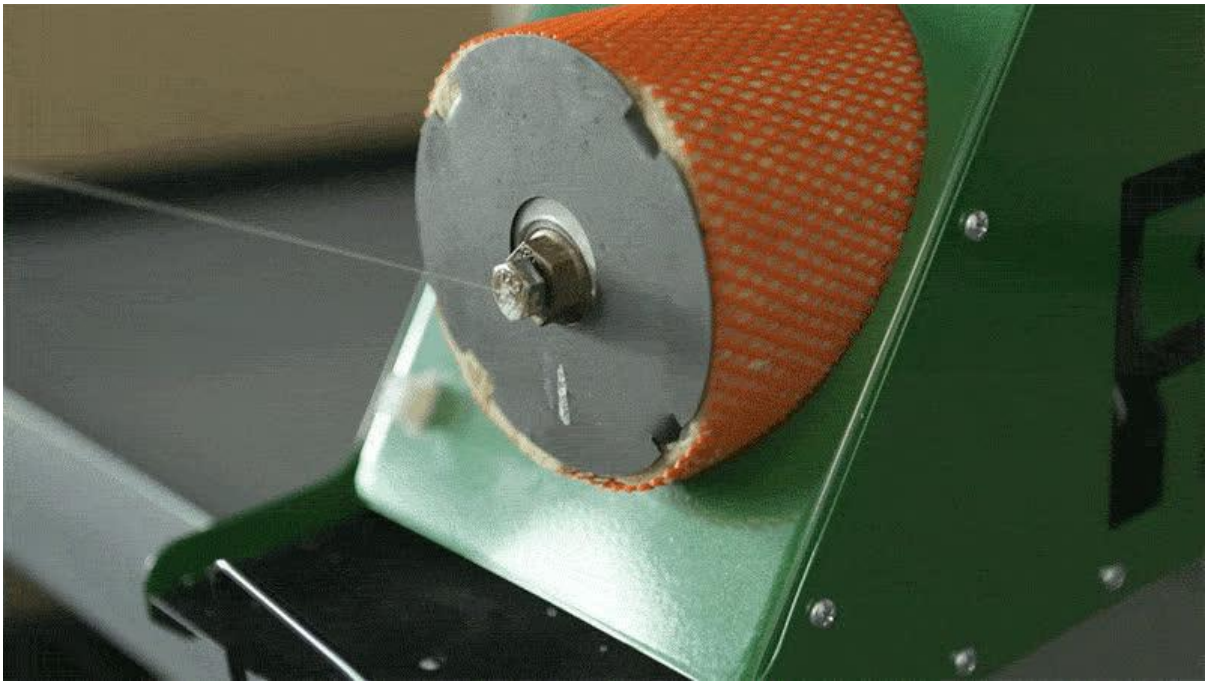

https://learn.adafruit.com/diy-3d-printing-filament

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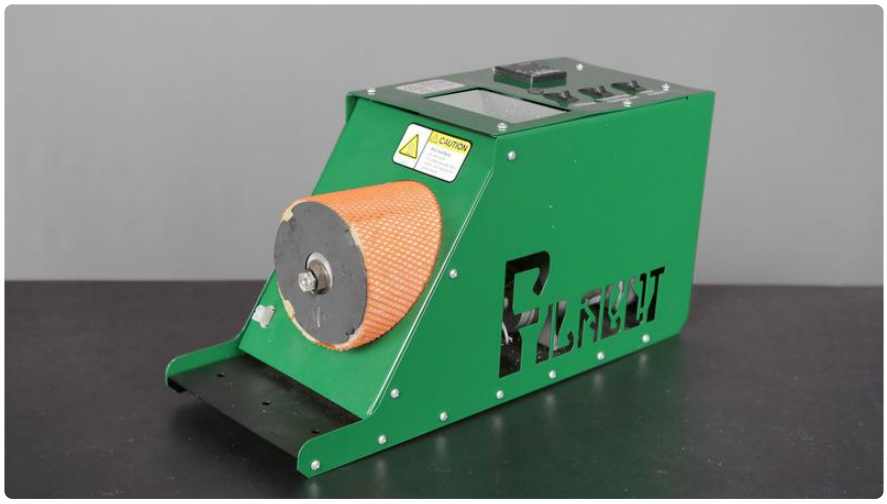
Overview

In this guide you'll learn about recycling failed prints to create DIY filament. Sustainable 3D printing saves you money and reduces waste.

Discarding your failed print may sound as easy as tossing them in the blue recycling bin, but most Recycling Centers don't accept failed prints since there is no manufacturing labels on them.

When 3D Printing becomes more than just a hobby, a whole lot of waste comes out of prototyping. Recycling bad prints helps lower the environmental impact on wasted plastic.

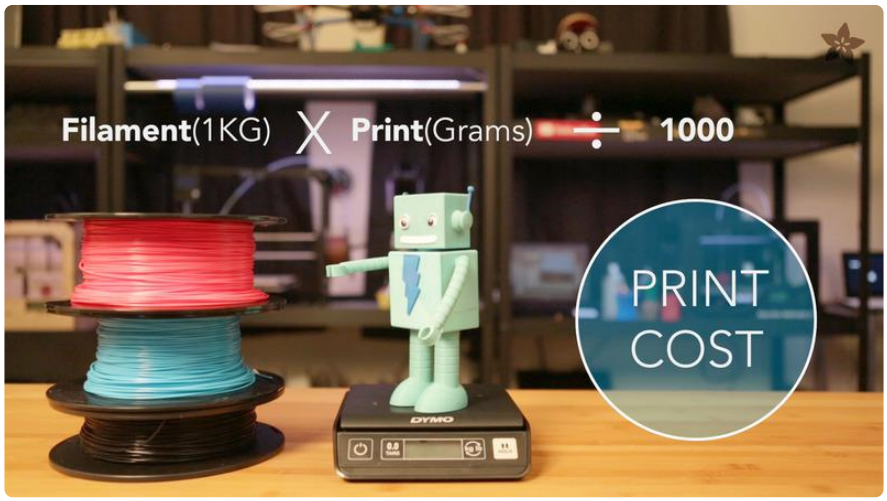


Filament extruders like the Filabot can recycle failed prints by crushing down small shredded pieces and allowing it to extrude out into recycled filament. You can make filament from standard, widely available plastic chips, or from recycled plastics from a variety of sources.

Tools & Supplies

- Filabot Extruder ()
- Super Scissors ()
- Hakko Precision Flat Pliers (http://adafru.it/1368)
- Fine Tip Curved Tweezers ()
- Digital Caliper ()
- Rubber Mallet
- Electric Lawn Chipper ()
- ESD Brush ()
- Tweezers ()

Print Cost



Using this simple equation above, you can determine the price of a 3d printed part. This equation works best with one kilogram of filament material.

$40 x 110 / 1000 = $4.40

Filament cost represents the cost of a 1KG spool of filament, multiplied by the weight of the print in grams (110), divided by 1000 equals print cost.

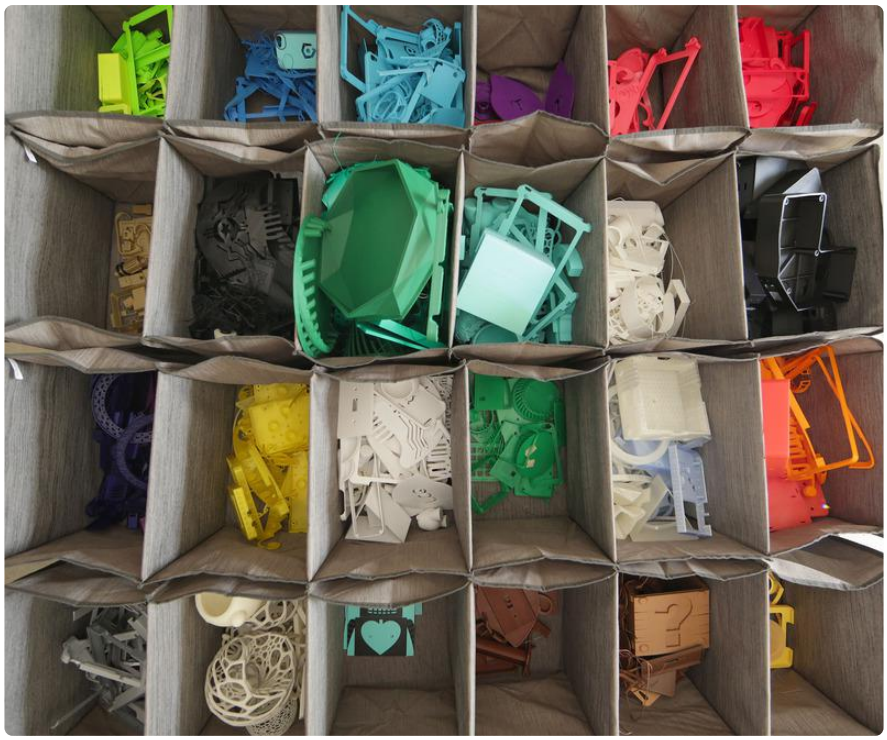
A 1KG spool might be as little as $20 for budget PLA filament, if bought locally or if you already have a shipping subscription service like Amazon Prime. Brand-name filaments, non-PLA materials, and/or having to explicitly cover shipping can drive this up.

Use this to calculate how much your prints cost or how much material you can save by recycling. Some 3D “slicing” software also measures cost per print.

Preparations

Collect, gather and store

If you're already saving your fail prints, you're doing awesome! If not, you should start saving them! You have the option to store them how ever you find efficient and convenient. Keep them in garbage bags or plastic bins. Over time you may find yourself with lots of junk, but you should hang on to the big stuff. You may discard the stringy stuff.



Sorting Parts by Material & Color

If you're interested in producing consistent colored material, you'll need to separate your parts. You should be able to distinguish ABS from PLA and sort accordingly. You can use whatever method of sorting, but we used a few shoe dividers to keep the parts separated.

Salvable Parts

Take in consideration what parts are recyclable. For the best results, you should only recycle parts that do not contain any paint, dirt, adhesives or any other solvents or chemicals. Note that these parts are going into a machine that melts plastic and extrudes it out. If the parts are dirty or have paint, the filament will have these impurities.

Crush and Smash

Break down bigger parts by using a rubber mallet. Prevent pieces from getting everywhere by smashing parts inside of a tarp bag.

Shred, Grind and Chomp!

An electric powered lawn chipper greatly speeds up the preparation process. If you already have a grinder or electric chipper, you'll need to clean out the blades and insides as any debris will add impurities to the recycled filament. We recommend using a chipper specifically just for plastic. The electric chipper pictured above allows 1.5" pieces to be shredded.

Use the chipper in a well ventilated area. A face mask is recommend as PLA can turn into dust.

Capturing chips and mulch

A tarp bag is placed over the bottom of the electric chipper where the shredded pieces will shot out from. A plastic feeder is used to push the parts down into the top of the chipper.

Material Properties

Notice that ABS material grinds down well into a mulch material. PLA material tends to break down into chips and powder.

Extrusion

Install Extruder Nozzle

Mount the 3mm bolt nozzle to the extruder with a socket wrench and tighten the bolt to secure it on. This can be done with the extruder all the way off.

Set Material Temperatures

Extrusion temperatures are significantly lower. Since there is no need to bond with layers, the temperatures need to only be hot enough to melt the plastic scraps together.

ABS Temperatures

165C to 180C

PLA Temperatures

160C to 170C

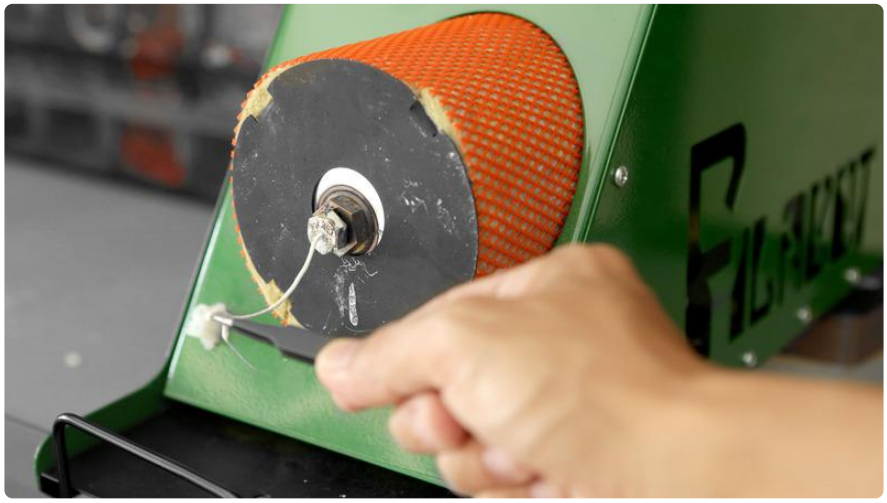
Tweak Settings

The temperature ranges are approximate. It will require some trial and error to determine the right processing temperatures. Keep notes of actual temperature settings with different types of plastics, along with other operational notes, to develop a procedure that works well in your situation.

Feed Hopper

Once the machine is heated, fill the hopper half way. Use a cleaning brush (http://adafru.it/1209) to remove any material from the controls and inside the walls of the hopper. As you add more material, stir up the current material to mix up the blend.

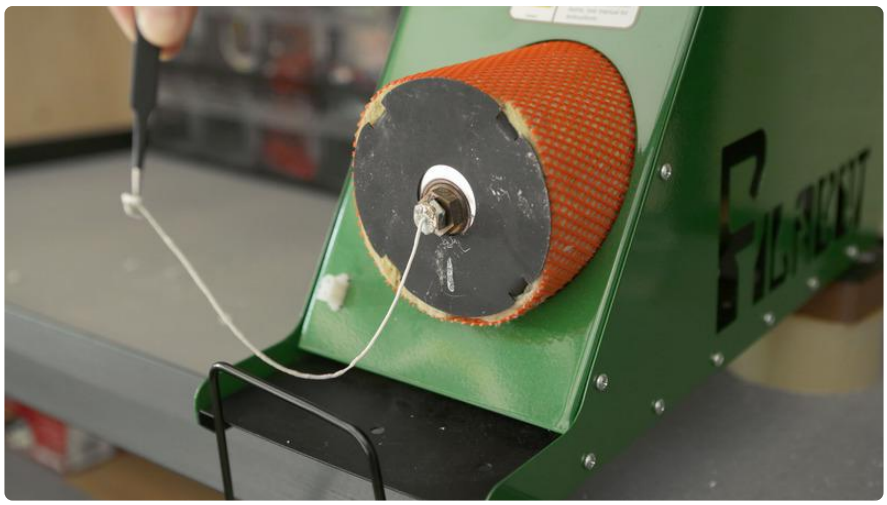
Don't fill hopper all the way. As the feed screw turns, the material tumbles and may overflow.



Break in Steps

You'll need to clean out the extruder from the manufacturing process. Use the plastic pellets that is included with the filabot and extrude for about 2 hours. Keep extruding filament until the metal shaving are cleaned out of the feed screws.

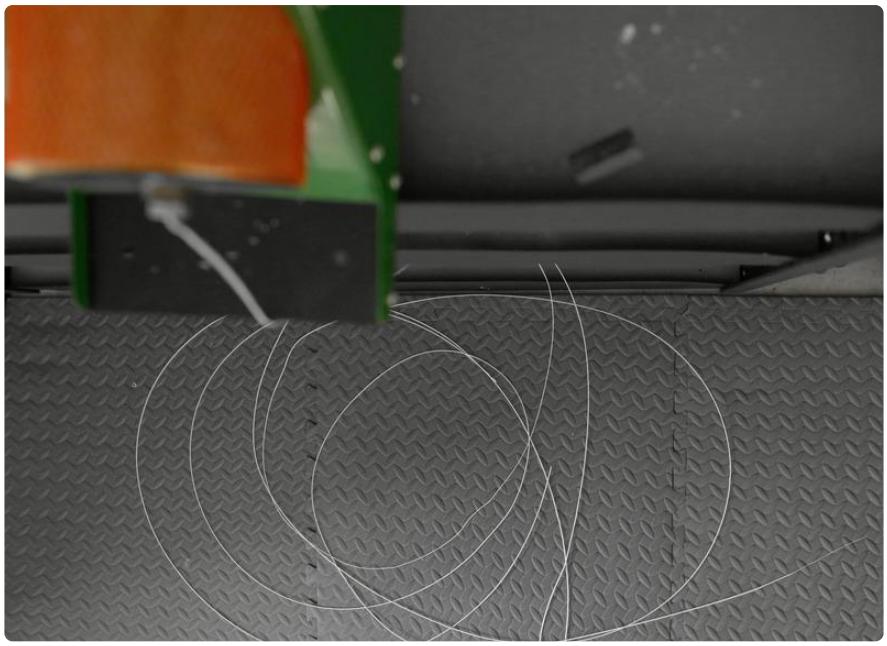
Do not use the break in filament as it will have metal particles that could damage your 3d printers nozzle.



Coiling Extrusion

Elevate the extruder at least 24in to 40in off the ground to allow the filament to properly coil. Place the extruder on a well supported surface with the extruder facing the edge of the surface. Try to avoid tampering with the filament as its extruding, even the slightest movement can cause the filament to dent.

Don't touch filament as it's extruding. It's very hot and can cause imperfections in the filament.



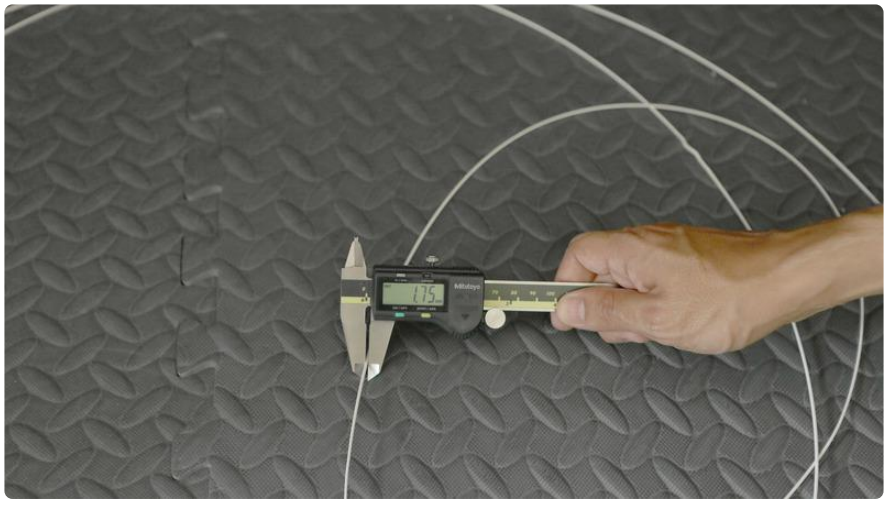
Guide Filament

Gently guide the filament into a natural spiral, either direction works fine. To get a consistent filament, avoid tugging on the filament. Touching the filament will cause inconsistencies in the filament diameter. Touching the filament while its extruding introduces bends and changes in the diameter.

The goal is to make the filament coil so you can spool it.

Place a fan about 2 feet away from the extruder. Point it to the coil on the ground to cool down the filament. This helps the filament solidify quicker.

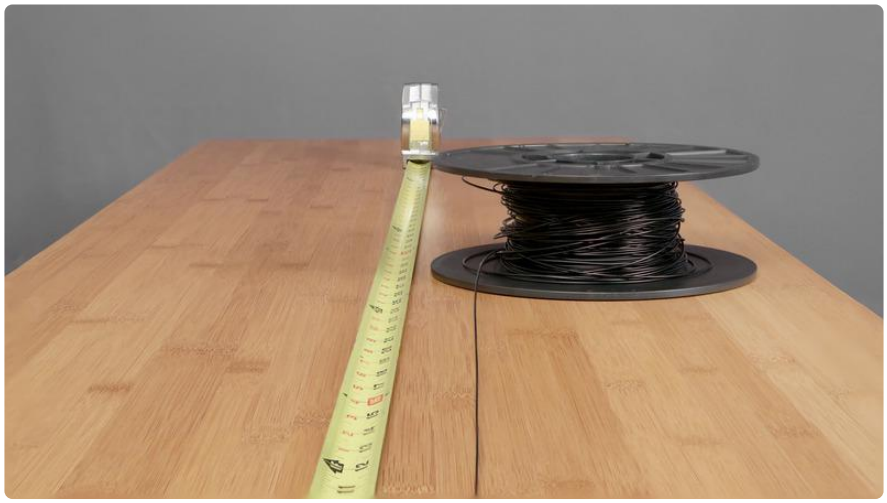
The start of the spiral is the hardest, but once it has spiraled around twice it should take care of itself and self coil.



Measure diameter

After the filament has coiled a few more times, carefully measure the filament diameter from the filament in the coil. If filament is too large increase the temperature of the of the extruder by a few degrees, if the filament is too small lower the temperature by a few degrees.

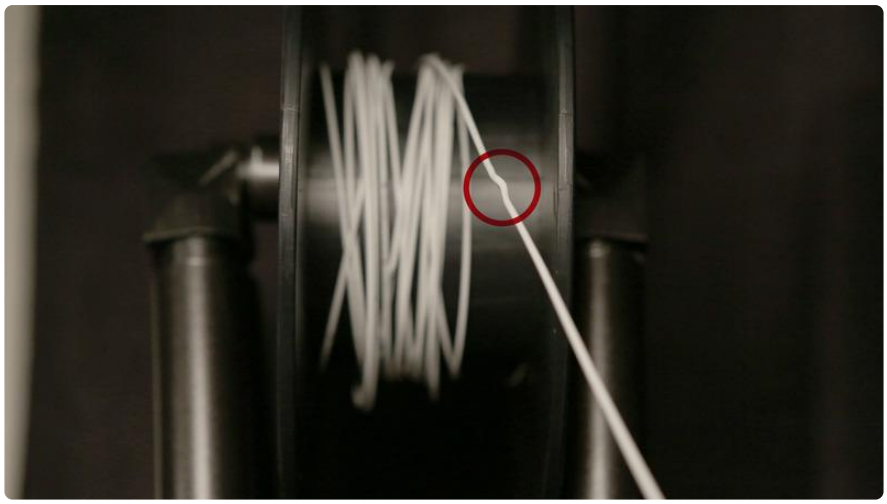
3D Printing



Once enough filament has been made to print a desired part, shut off the extruder. From here the filament can either be spooled or feed directly into the 3D printer.

Spool

You can reuse old spools for your new filament! Most spools have a small hole near the inside. Guide the filament through and either hand spool or use a drill to build your own spooler.



Check that no bends are present in the filament!

Spooling Filament

Handspooling filament can be a lengthy process depending on the amount of filament. Patience is key here, don't try to rush through spooling, as it could introduce knots, kinks and other elements that could damage the filament.

Printing Tempratures

Printing with recycled filamnet didn't require lowering or increasing any settings. If prints have trouble bonding, increase the heat by just a few degress. If the print looks like it's melting, try decreasing the heat by a couple of degrees.

ABS

230c - 240c

PLA

220c - 230c