

Material Handling

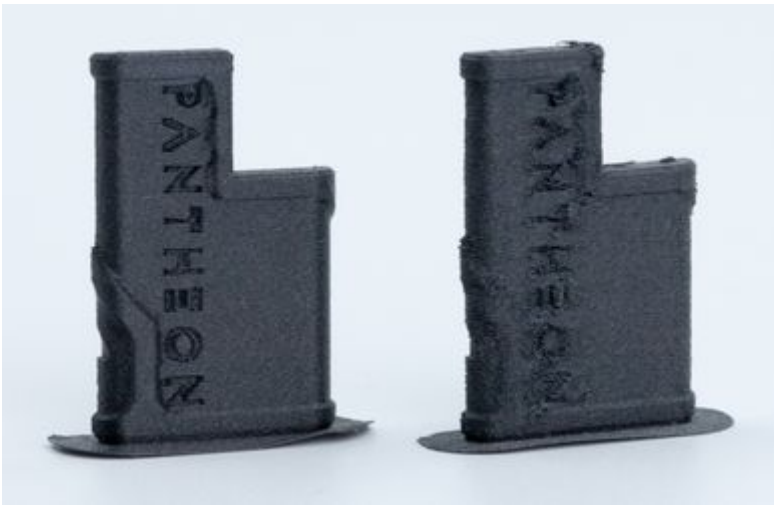
Filament Moisture

Wet filament is the number one contributor to failed/poor-quality prints.

What is Wet Filament?

Plastics are hygroscopic and readily absorb moisture from the air. If spools of filament are left out they can gain upwards of 1% of their mass in water content. When wet filament is passed through a hotend, the water boils off as steam and exits the nozzle orifice, causing uncontrolled extrusion of material. If the filament is very wet, you can hear hissing, popping and crackling noises and even see steam or bubbles in the filament when extruding in the air.

This tends to show up in prints as excessive stringing and poor surface quality.



Keeping Filament Dry

Our filament cartridges are airtight and feature a Hygrometer to help keep your filament moisture-free when printing. It is important to maintain a humidity level of $<10\%$ and to recharge the desiccant inside the filament cartridge when necessary. One must minimize the amount of time the lid is open to keep the air inside dry.

TIP With an approximate volume of 1050 cubic inches, you will need 25 grams of silica gel to protect the spool inside.



Desiccant Types

TIP In the past we have experimented with a variety of desiccants varying from clay types to activated alumina and have found that **silica gel is the most effective** and what we recommend to use in our filament cartridges.

Additional desiccants can be purchased at this link on our store

<https://shop.pantheondesign.com/products/dessicant-packs>

Alternatively, you can purchase large volumes of desiccant from

<https://www.uline.ca/Product/Detail/S-3905/Desiccants/Silica-Gel-Desiccants-Gram-Size-5-5-Gallon-Pail>

Drying Filament

Our filament is dried and vacuum-sealed before shipment so that they are ready to print straight out of the package. In the case that you have to swap filaments or store material in the open, you will need to dry the material before printing. We recommend using a food dehydrator to raise the spool temperatures and remove moisture.

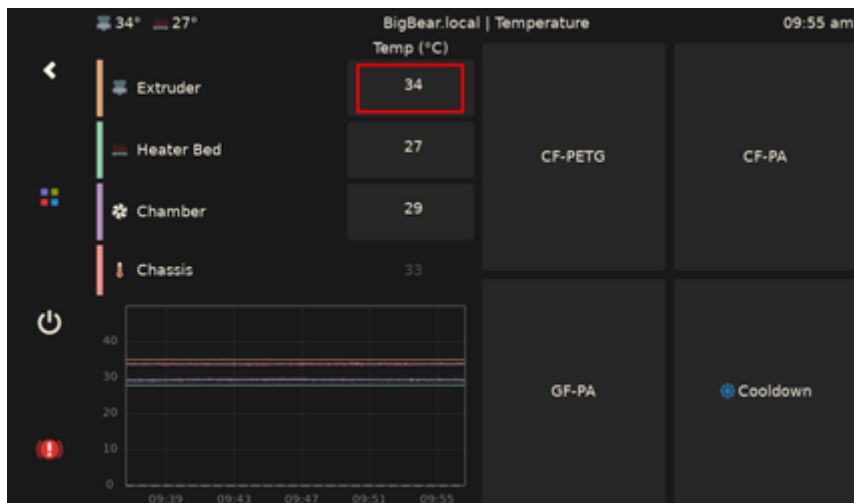
PETG	Nylon
70°C for 24h	80°C for 48h

Testing Nylon Filament Moisture

Please read all the steps before starting, as they are timing-sensitive.

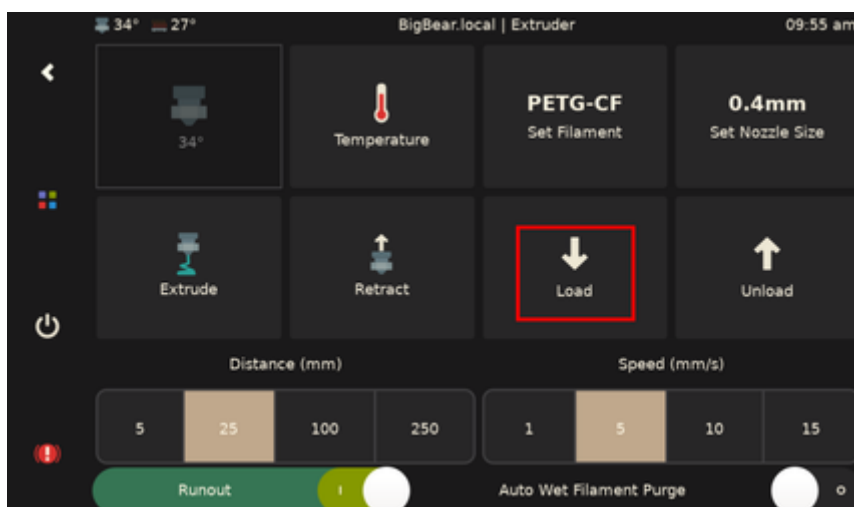
Preheat

Set the extruder to 320C for nylon by clicking on the extruder temperature. If you are testing filament that has been sitting in the printer for more than a day, you will need to remove the first 1 meter of filament above the extruder and reload the filament to test the actual protected filament in the spool holder.



Prime Extruder

Have a timer ready on your phone. Press the load macro, and watch the extruder gears spin. Immediately pull the filament strand off the nozzle when the extruder gears stop, and start a timer for 30 seconds. You can discard this filament strand. The purpose of the extrusion is to build hotend pressure.



Flow and Measure

At the end of the 30 seconds, pull the filament strand off the nozzle, and measure it with a ruler, and compare with the chart below:

Filament Strand Length	Less than 35mm	35-50mm	Greater than 50mm
	Your filament is very dry and in optimal print condition.	Your filament contains some moisture but is usable.	You will likely run into print issues. Dry your filament in a dehydrator to revive it.

Swapping Between Filament Types

There are 3 different ways to swap between materials types.

Each way has its own pros and cons. It is your judgment to evaluate which is best for you. It is recommended to keep track of the filament type in any of the components that have been printed so that you can reinstall it in the future when swapping back.

Nozzle Swap and Purge



- Low time intensive
- Low labor intensive
- Low cost intensive
- Potential risk of clogging

Replace a Nozzle

Least recommended.

This process is the most prone to jams.

Print Core Swap

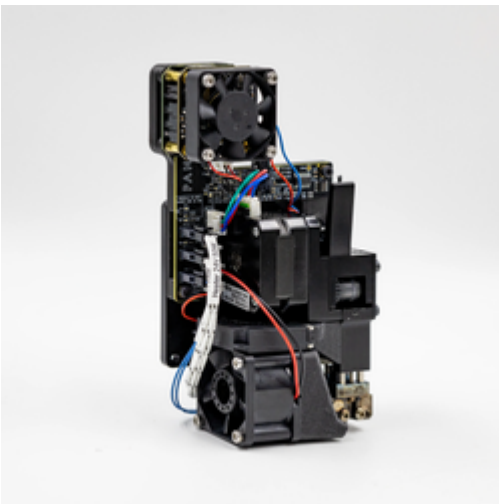


- High time intensive
- High labor intensive
- Medium cost intensive
- Zero risk of clogging

How to Replace a Hot End

Most recommended procedure.

Printhead Swap



- Low time intensive
- Medium labor intensive
- High cost intensive
- Zero risk of clogging

Install and Remove A Printhead

The safest option, but requires stocking spare printheads.

Nozzle Swap and Purge

https://www.youtube.com/watch?v=rxFBfW3PUHE&t=11s&ab_channel=PantheonDesign

- Move the axes to X150 Y150 Z300. This will give you working room to remove the nozzle.
- Heat the printhead to 100C. This will soften the material inside the hotend and make it easier to remove the nozzle.
- Using a 7mm nut driver, remove the nozzle.
- Heat the printhead to the printing temperature of the material currently in the hotend.
- Feed the new material into the printhead and run the “LOAD” macro until you see the new material. This will push out the old material in the hotend.
- without the nozzle installed, purge 300 meters more material to purge remaining old material by hitting the “LOAD” macro 3 more time.
- Using tweezers or pliers, remove the extruded material.
- Install the new nozzle.

Print Core Swap

- Unload filament using the unload button on the extruder screen.
- Follow hot-end removal/installation instructions here → [How to Replace a Hot End](#)
- Load new filament.

Printhead Swap

- Unload filament using the unload button on the extruder screen.
- Follow print head removal/installation instructions here → [Install and Remove A Printhead](#)
- Load new filament.

Filament Handling

Opening a New Spool

When opening a new spool, try to move it immediately into a spool holder. Do not leave it on the counter while you grab a coffee, etc.

Spool holder

On the spool holder, make sure:

- The humidity is at 10% or lower, if higher, refill with dry desiccant.
 - When you open the spool holder, it will spike up but should settle back within half an hour.
- The latch is always closed, this preloads the foam seal.

Detailed instruction on spool holder operation below [Filament Cartridge Operation](#)

Filament Storage

The best place to store a spool is in a Pantheon spool holder, if that is not possible, a sealed Tupperware with desiccant is an acceptable alternative.

When swapping a partially used spool, make sure you store the partial spool in a sealed container with desiccant.

TIP A plastic sealed bag with no desiccant is not a acceptable storage solution, water molecules are tiny, so tiny in fact that they can work their way through the plastic of the bag.



Filament Cartridge Operation

NOTICE The filament cartridges design has been updated as of summer 2024; this procedure is still valid for the updated design.

Loading Filament Cartridge

1. Turn knob quarter-turn counter-clockwise and lift lid.

2. Load fresh desiccant if needed



1. Load filament spool between rollers.
2. Find loose end of filament and feed into PTFE tube fitting at the top



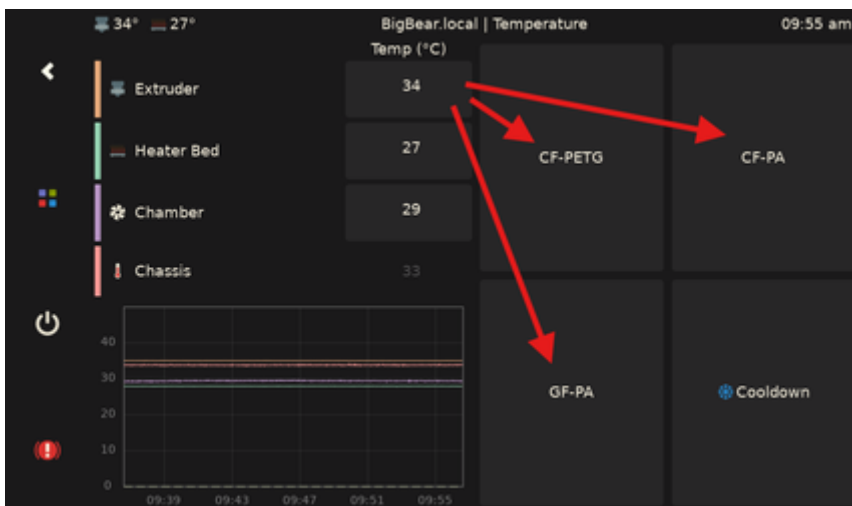
1. Close lid and turn knob quarter-turn clockwise.

TIP Monitor the filament cartridge humidity using the hygrometer. If it displays greater than 15% relative humidity after stabilizing for a few hours be sure the replace the desiccant.



Loading Printhead

1. Preheat hot end using front display, select the appropriate filament temperature.



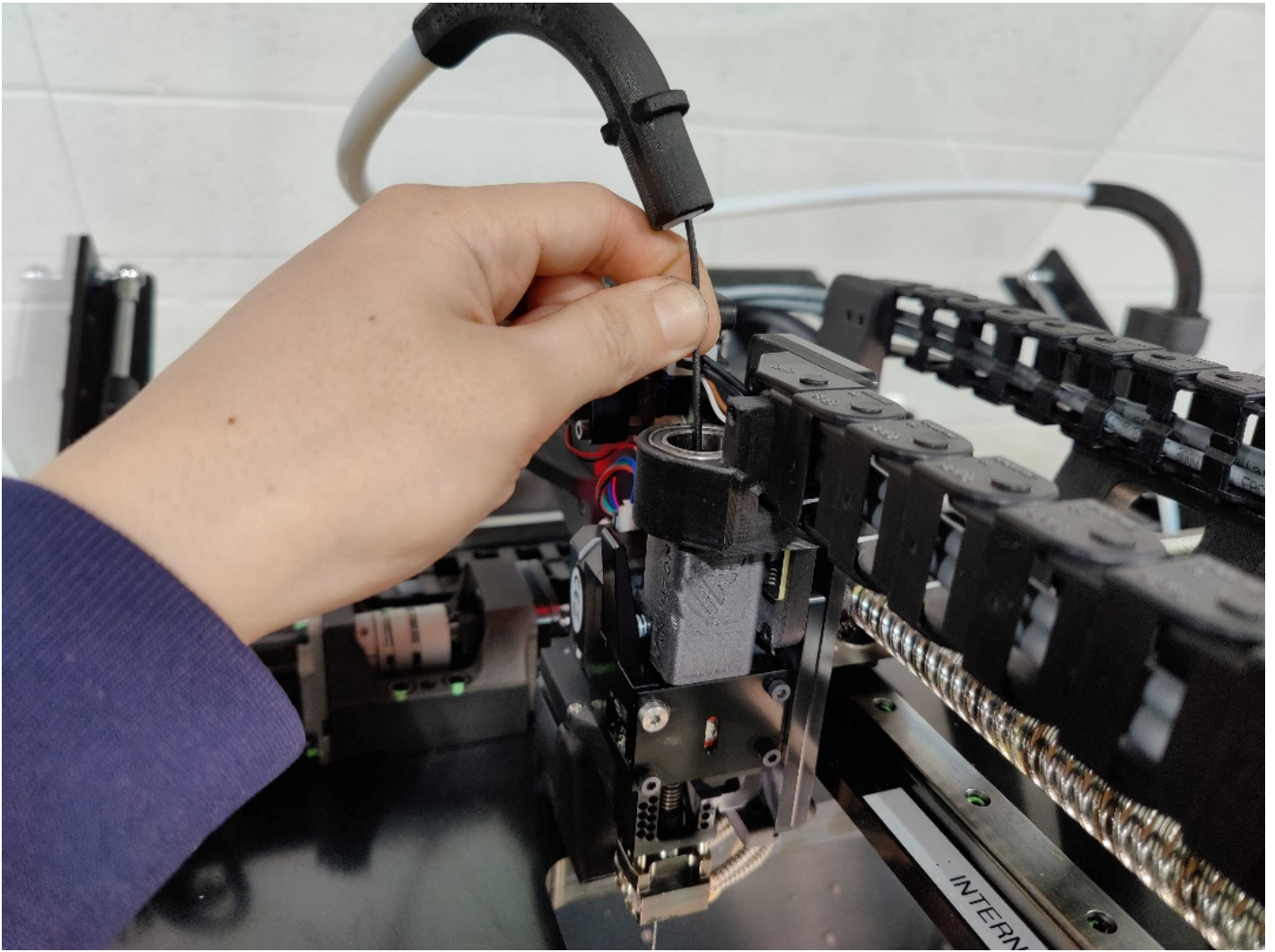
1. Insert PTFE tube into filament feed on HS3 right panel near upper rear corner.



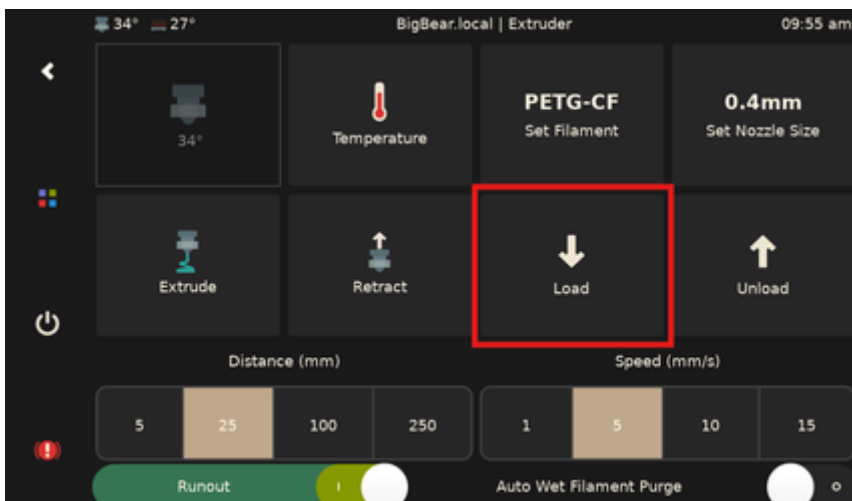
1. Open HS3 lid to access printhead filament elbow, lift out of bearing holder and set aside.
2. Disconnect PTFE tube from filament cartridge if connected. Feed filament through PTFE tubing by hand until filament appears at the end of the elbow.



1. Reconnect PTFE tube to filament cartridge.
2. Fully insert filament into printhead until the end of travel.



1. **If you are loading a different material than previously printed, complete these instructions before proceeding to the next step: Swapping between filament types**
If you are loading the same type of material or this is a brand new Hotend proceed to the next step.
2. When the nozzle is hot, select the load filament macro on the display. The printhead should now pull filament into the extruder. If you do not see any filament movement, manually feed the filament until you feel the extruder rollers grip.

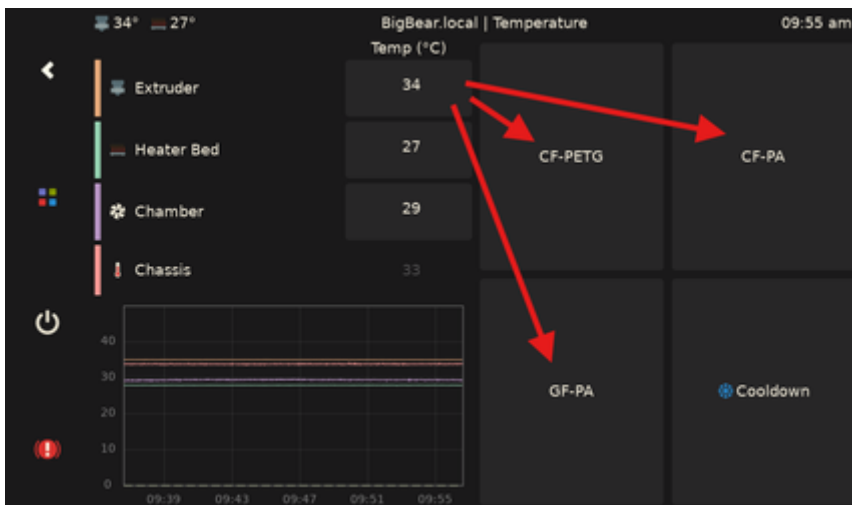


1. Check to see material has been extruded at the nozzle. If no material is seen reselect the load filament macro again. Remove any extruded material and clean the nozzle.
Persistent oozing is normal.
2. Reinsert the filament elbow. The printhead is now loaded and ready to print. Cooldown the printhead if you are not starting a print immediately.

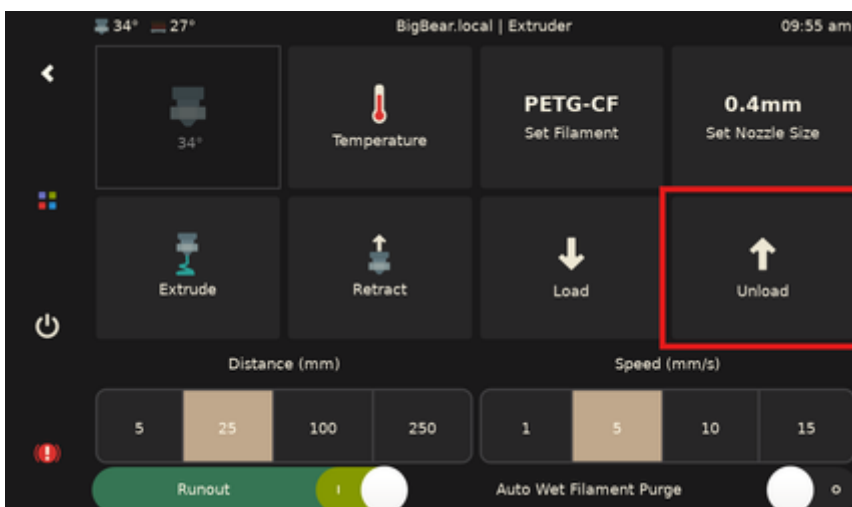
CAUTION Avoid leaving the nozzle preheated for long durations as it burns the filament inside which may lead to clogs.

Unloading Printhead

1. Preheat hot end using front display, select the appropriate filament temperature.



1. Open HS3 lid to access printhead filament elbow, lift out of bearing holder and set aside.
2. When the nozzle is hot, select the unload filament macro on the display. The printer will first feed then pause for a moment before unloading the filament. This operation takes approximately 20 seconds. Once the filament is free you can pull it out with minimal force.



1. Cooldown the printhead if you are not loading new filament immediately. The printhead is now unloaded.

CAUTION Avoid leaving the nozzle preheated for long durations as it burns the filament inside which may lead to clogs.

Unloading Filament Cartridge

1. Turn knob quarter-turn counter-clockwise and lift lid.
2. Loosely grip filament at bottom of PTFE tube fitting with left hand, and reel in the spool with your right hand. Watch for the end of the filament to avoid tangling in the spool.
3. Secure the filament with tape or in the holes at the rim of the spool.



Pull the spool ejection tab at the bottom left with your left hand, and grab the spool with your right hand.

1.



The filament cartridge is now unloaded. If not loading a new spool immediately, reset the spool ejection tab and immediately close the lid to prevent the desiccant from saturating.

Revision #1

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