3D·UP FITTERS

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Ender 5 Plus R1 Enclosure Kit

Installation Manual 2.0

April 2022

We forgot to put something on this page.

You Really Do Want to Read the Directions

Hey, we get it. You just got your new enclosure kit and want to start using it as fast as possible. How hard can assembling a few plastic panels possibly be? It's not really that hard, assuming you're following the directions, but try to use brute force and you'll end up working your way through your vocabulary of swear words. While the acrylic pieces in the kit are strong, they are still plastic and will break if bent far enough. The ghosts of the broken panels that have gone before you have become much stronger than you could ever imagine, and are whispering into your ear, "just be a little careful."

Before you Start

Is This Manual for *Your* Kit?

This installation manual covers the R1 enclosure design for the Creality Ender 5 **PLUS** printer. If you have a different version of the enclosure, please read previous versions of the manual available on the website.

Is your Printer Customized?

If your printer is stock, then no customization is needed. If you have customized the printer, you should examine any modifications to ensure they don't block the panels. If part of one of the panels is blocked, you can use a laser or drill to customize one or more panels. **This should be done before removing the plastic or paper covers on the acrylic panels. Cutting acrylic requires great care as the plastic can crack if mishandled.**

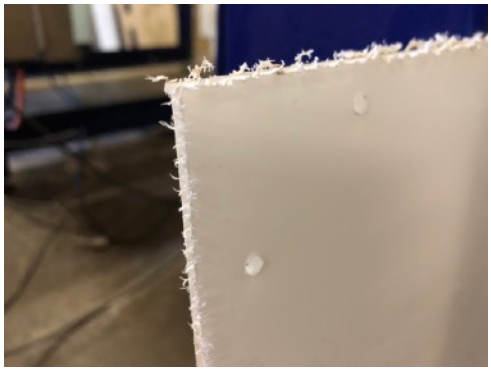
Preparing the Printer

Remove any filament from the hot end (which will require heating the hot end) and remove the filament spool from the spool holder.

Turn the printer off and unplug the power cable from the printer's power supply.

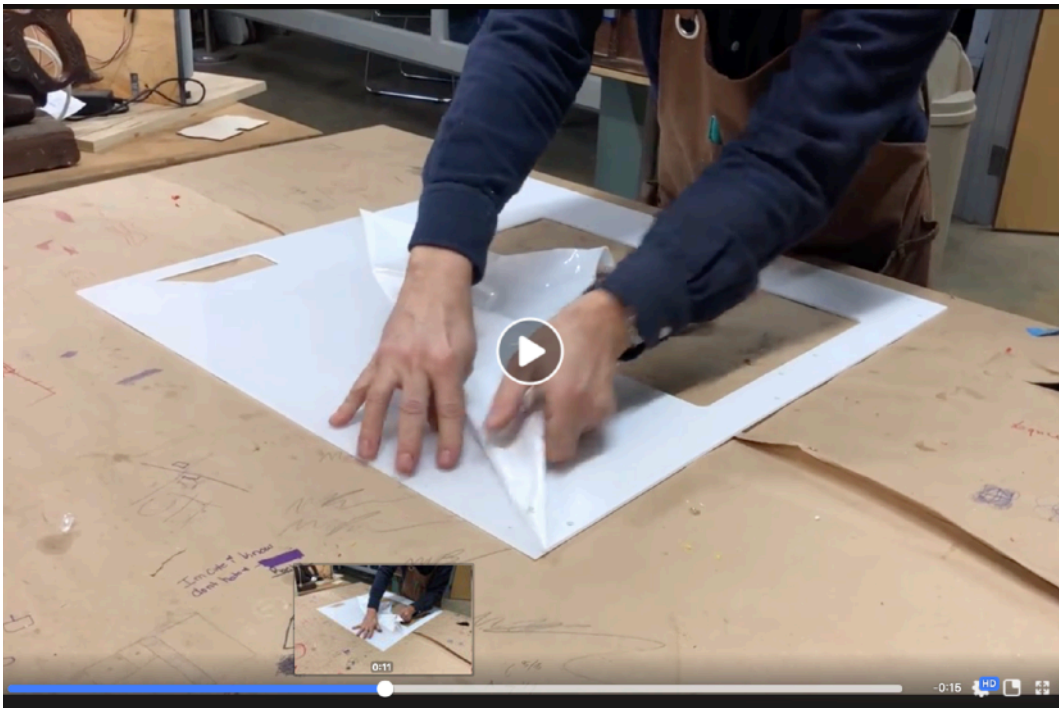
Don’t Panic If You See This!

If you can’t see through the plastic, please don’t panic! What you’re seeing is just the plastic or paper protective covering.



When plastic sheets are manufactured they are covered by either a paper (brown colored) or plastic (white) covering to protect against scratches. Follow the directions below to remove the cover and discover the beautiful plastic underneath.

To remove the covering from an acrylic panel, lay the panel flat on a table. Then peel up a corner of the covering and **CAREFULLY and SLOWLY** pull horizontally to the sheet to reduce the lateral forces that would bend the acrylic. This video shows just what to do.



https://www.3dupfitters.com/blogs/news/acrylic

Everything You Wanted to Know About Screwing But Were Afraid to Ask

Screw	Tool Needed	Usage	Relative Size
30-50mm Hex Cap Head	3mm Hex Wrench	Attach fan/filter, attach large front latch mounts	 30mm Hex Cap
12mm Hex Cap Head	3mm Hex Wrench	Connectors, hinges	 12mm Hex Cap
16mm Hex Cap Head	3mm Hex Wrench	Knobs, small latch mounts on some models	 16mm Hex Cap
#6 3/4” Wood Screw	Philips Head Screwdriver	Attach magnetic latch to mount	 3/4 #6 Wood Screw

The most confusing thing about assembling this enclosure will be which fastener or screw to use. Luckily it's pretty easy to figure out once you know the system. While the same screw to use will be detailed in each section of the manual, you probably won't need to refer to it once you know the secrets.

The most common screw is the 12mm hex cap head screw. The 12mm screws are long enough to attach things to the acrylic front, top, sides, and back. Each section will describe exactly which screw to use, read carefully, and use the specified screw for the best results.

The actual length of the "long" screws to attach the fan and or filter will vary depending on the depth of the particular shipment of fans we happen to get that month. They won't be hard to spot since they'll be the longest thing in the bags.

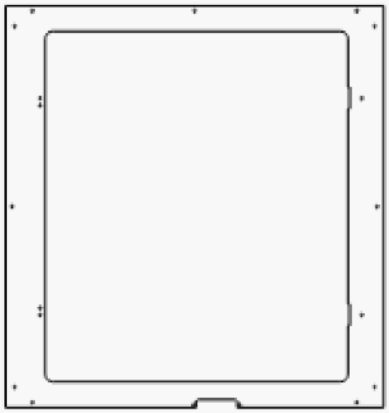
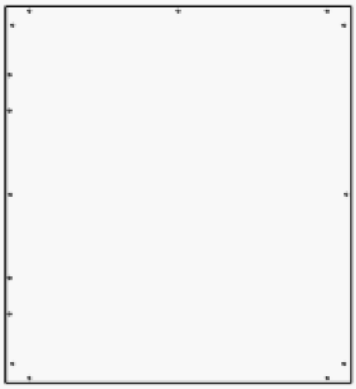
Finally, and we can’t stress this enough:

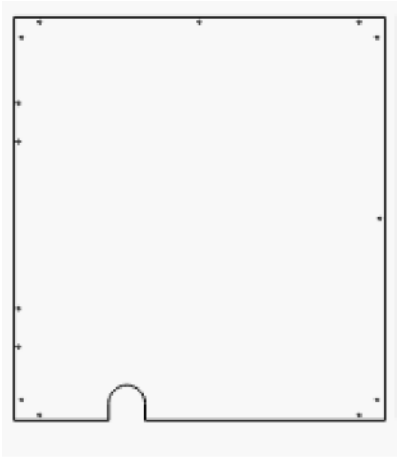
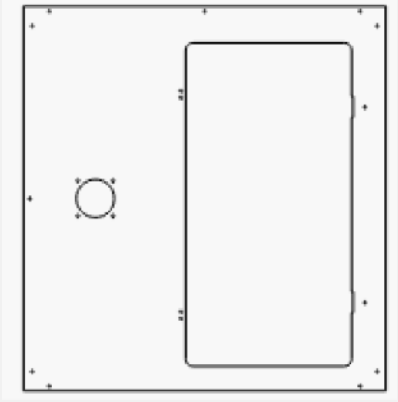
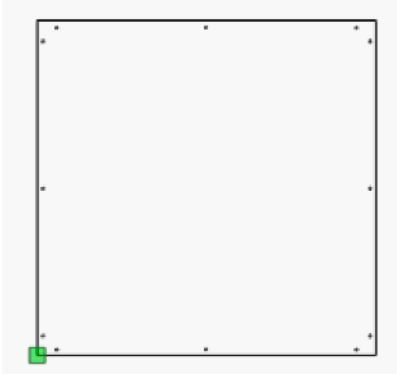
DON’T OVERTIGHTEN THE SCREWS

Leave the screws a little loose until the end adjustment phase. During that process, you’ll be hand-tightening until the screws are snug, but you can easily use so much force on the plastic pieces or the acrylic crack. Please don’t be *that guy*.

Identify Panels

Before you assemble the kit, layout all of the panels and identify which panel corresponds to the front, left, right, back, and top. Although the panels are labeled, it's easy to get them mixed up once the covering is removed, and rarely a panel can be mislabeled. This chart will help you keep them straight. Note that the panels are shown as they appear if you are located on their corresponding sides, i.e., the right side is pictured as if you were standing on the right side of the enclosure, etc.

PANEL	PICTURE	HEIGHT	WIDTH
FRONT		31”	29.22”
RIGHT		31”	28,.5”

PANEL	PICTURE	HEIGHT	WIDTH
LEFT		31”	28.5”
BACK		31”	29.22”
TOP		28.8”	29.2”

Assemble Panels

The front panels are made from thicker 1/4" acrylic to provide more structural rigidity where needed: the door. Do not try to bend the 1/4” acrylic! The remaining panels are all 1/8”.

1. The Front Panel

Top Left

Top Right

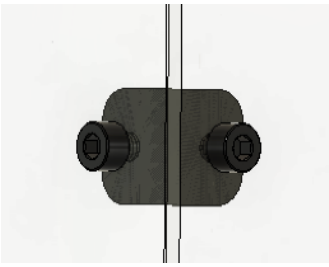
Bottom Left

Bottom Right

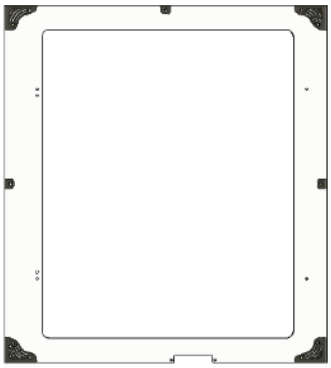
Each of the corners of the enclosure will be held together by the connectors pictured below. There are only two versions, L and R, which can be identified by the letters stamped on the inside. The opposite connectors are identical, i.e., Bottom Right is the same as Top Left. In all cases, the surface of the connector with the cutout pattern faces front or back.

The front door is designed so that the latches are on the left. Attach the corner connectors on the **backside** of the door frame using the provided cap head 12mm

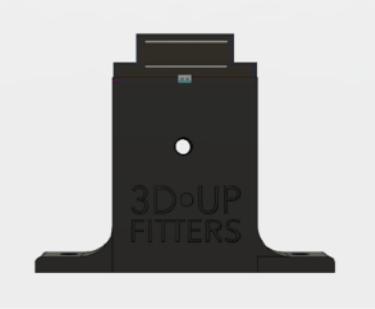
screws. See the photos below. The top of the connector should be flush with the acrylic top.



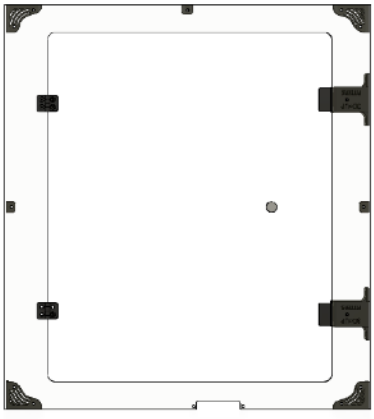
There are also smaller connectors at the top and right sides when viewed from the front. The front should look like the picture to the right.



Locate the magnetic latch and use the **wood screws** to attach them to the latch mounts. Hand tighten and make sure they're secure, but do not over tighten, or they may strip. The latch can be later adjusted front-to-back to ensure the door is flush with the door frame. Each latch mount is attached via one M4 30mm cap head screw.



Attach the door and door frame hinges using M4 cap head 12mm screws and nuts. There will be some play in the hole size so that you can adjust the door to swing freely.

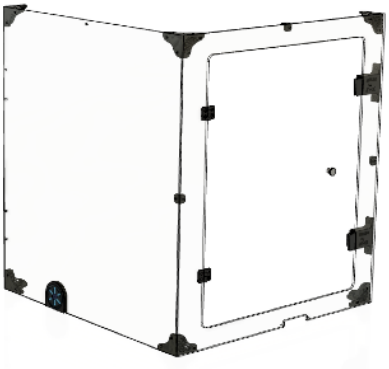


Attach the doorknob by first inserting the square M4 nut into the slot. Use a 16mm cap head screw to attach the door.

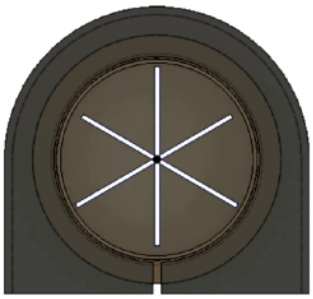
Now that the latches are mounted, it is time to connect the strike plates. Each plate comes with a squishy adhesive covering the exact size of the plate. Carefully attach the adhesive side to the acrylic at the location of each latch. Then, adjust the width of the metal strike plate so that it is held on by the pressure of the two sides of the plate. The adhesive covering will keep the metal strike plate from scratching the acrylic.

2. Left Side Panel

Attach the left side to the front forming an L-shape that will stand up on its own, then attach one L and one R connector at the back. Then attach the two mid-panel connectors on the top and back as shown. The Ender 5 Plus design adds a side port for a grommet and grommet holder. This makes it easy to take off the enclosure without unplugging the printer.

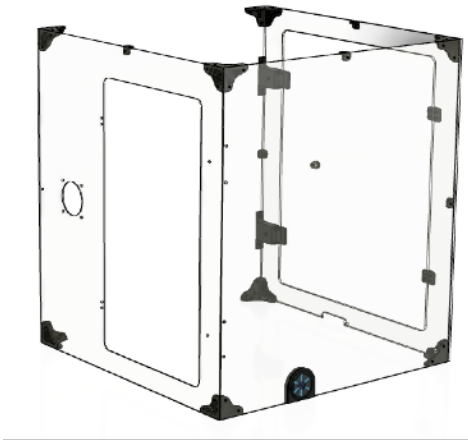


First, insert the grommet into the grommet holder, then run the power supply cable through it, for easy access to the extruder. The assembly slips into the similarly shaped opening in the left-side acrylic.

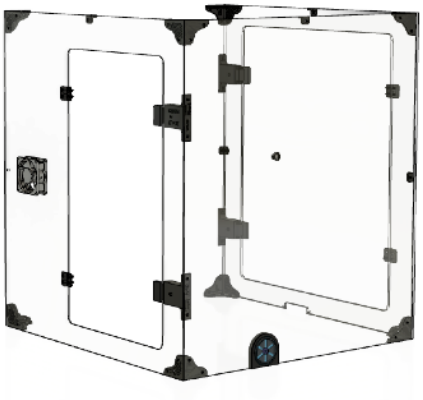


3. Back Panel

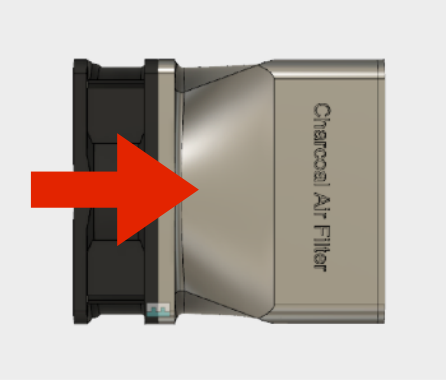
The back of the enclosure will be a little more complicated since it contains a door. Start by attaching the back panel to the front and left-side panels. The four corner connectors are mirror images of the front. The large hole is either for the fan, the option of an air filter (purchased separately), or completely covered up by printing a cover on Thingiverse. On each side are “mid-panel corner connectors.”



Next, assemble the back door using the same techniques as the front door, i.e., hinges, latch mounts, and strike plates. The main difference is that the strike plates will need to be squeezed in to fit the smaller thickness of the back panel v.s. The front panel.



Finally, attach the fan confirming the direction of the fan’s air filter to pull air OUT of the enclosure. The illustration to the right shows the fan attached to the optional charcoal filter. Attach using M4 cap head 30mm or 40mm screws depending on the depth of the particular fan.



4. Top Panel

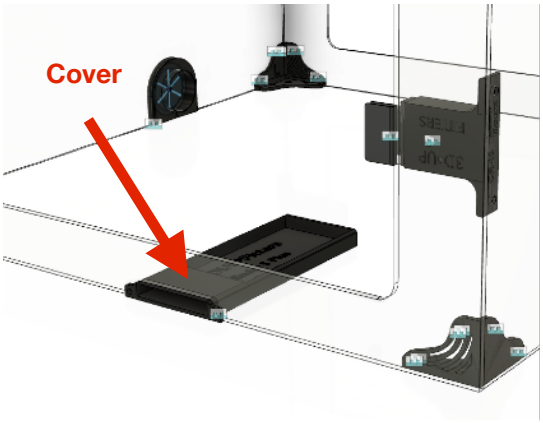
Use access through the doors to attach the top of the enclosure using M4 12mm screws.

5. Right Panel

The right panel is a plain simple affair by this point. Just make sure to locate the bottom of the panel, which is the only side without a hole.

6. Air Input Tray

There is an “air input tray” in front to get enough air to the electronics. It consists of two parts, the tray and a cover insert. Slide the tray into the front of the enclosure, and then lay the cover on top at the front as shown. There are holes to use 12mm M4 screws to attach the tray, but it's not needed in many cases. If you do connect it, it must be unscrewed before you can take off the enclosure.



7. Sealing Gaps

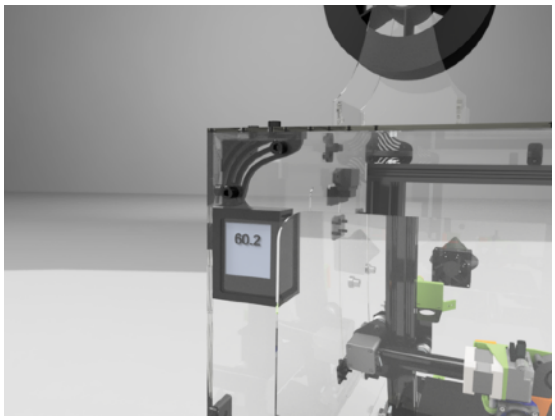
Once the enclosure is completely put together, it is time to make sure that each panel is held tightly to each adjoining panel. The connectors are designed with a small amount of play that allows you to make minor adjustments for the perfect fit.

1. Loosen screws on the panel to move.
2. Push that panel into place. You may need a friend to hold it tightly in the right spot.
3. Re-tighten the screws to hold the panel. Only tighten enough to hold the pieces snuggly. **DO NOT OVER-TIGHTEN!** These parts are sturdy, but they're still all made of plastic.

Repeat the product, going around the enclosure, looking to make sure all of the panels are flush with each other.

8. Temperature Gauge

The optional thermometer will let you know approximately what temperature it is inside the enclosure. It attaches to the left side of the door piece using the same hole as the top-most corner connector, as shown. It comes with a longer screw to fit through everything.



9. Managing Enclosure Temperatures

There's not much to a 3D printer enclosure. Although ours look fancy, functionally, they're not much different from putting a cardboard box over the printers since both designs are passively heated by the beds. How complicated can they be? This section will explain how they work and how to manage the temperatures to get quality prints while protecting your lungs.

We generally get two types of customers:

1. Those interested primarily on air quality.
2. Those interested mostly in print quality.

Think Airflow, Not Fishtank

The problem is that those two goals use two different techniques in terms of airflow. We use the same design as industrial equipment for the best air quality, which uses airflow to manage air quality. Because of physics, the amount of air moving into the enclosure has to be equal to the air moving out of the enclosure. When the air moves out of the enclosure carrying volatile organic compounds, it can be vented to the outside or run through an air filter.

People often ask us if the enclosures are airtight and have a bottom. If your primary concern is air quality, then being airtight doesn't buy you anything since the particles will float out when you open the door. By maintaining a negative air pressure, the particles are reliably kept away from human operators, which means having openings for air to both enter and exit the enclosure.

If the maximum internal temperature is the goal, being airtight also doesn't help since the leading cause of heat loss is conduction through the sides of the enclosure, not through small amounts of air loss. A bottom doesn't help either since while heat doesn't rise, hot air does, and thus almost all of the heat of an enclosure is at the top. However, a bottom is helpful if your table is too small for the enclosure.

Since airflow is critical, all of our enclosures come with fans chosen for CFM ratings to match the cubic size of the enclosures. This ensures enough airflow for cool-loving filament types like PLA to keep the temperatures in the safe zone.

Room Temperature

Passively heated enclosures depend entirely on the room temperature as a starting point. If you're trying to print ABS in an unheated garage in the winter, the temperature inside the enclosure will never get hot enough. The bed heater has only enough energy to increase temps from the baseline. If that baseline is 72F, you've got a good chance of getting into the sweet spot. If the baseline is 50F, you'll be lucky to break 72F in the enclosure itself.

ABS and Nylon

You want higher internal temperatures for filaments like ABS, which happens naturally because the recommended bed temperatures are higher. With the fans turned on, we shoot for internal temperatures between 35C and 40C for 3D printers that use E3D hot ends because E3D recommends that temp range avoid clogging. Keeping the temperatures in that range puts the least stress on the equipment and follows the manufacturer's guidelines.

This works great for people either interested primarily in air quality or those who are risk-averse and don't want to take a chance of clogging their hot ends or decreasing the useful life of their printers.

More experienced 3D printer owners, though, for whom a clogged nozzle is a known risk, might want to run the temperatures higher for less chance of warping ABS parts or printing nylon. In those cases, you can turn off the fans or even print one of the vent covers and not vent at all. We do the latter on our internal print farm on a couple of machines where the temperature when printing ABS gets as high as 46C. They've been running like that for years with no filament clogging. We've never had a power supply fail with no venting of the power supplies. Your mileage may vary as it depends on many variables, such as filament quality and the quality of the power supply in that particular printer.

If you're looking for the highest temperature possible, try turning the bed heater on for an hour before printing.

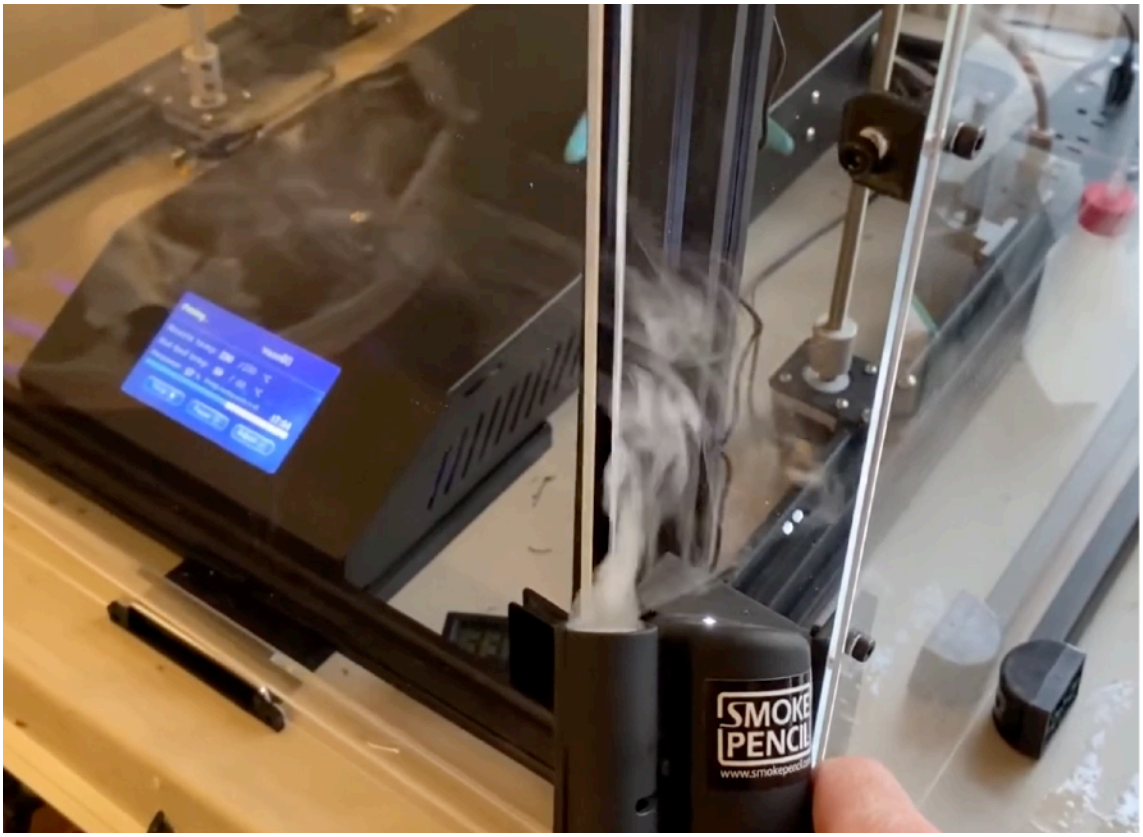
Perfect Enclosure Printing with PLA

Since PLA is happy at room temperature, the only reason to enclose it is for improved indoor air quality. PLA typically prints with a bed temperature of 60C so that it will heat the enclosure less than ABS right off the bat. Make sure to print with an enclosure fan and monitor the internal temperature, which should ideally be in the 30-35C range or lower if you can get it.

If you'd like to lower the temperature further, you can always buy a more powerful fan, but the easiest thing to do is crack the front door a little to increase airflow. But won't

that let out all of the volatile organic compounds coming off the hot end? The key is the negative pressure combined with the particles' minimal and light.

As you can see, the fan keeps the air flowing in and the harmful particles floating into the vent or filter.



3D Printer Design Matters

The other part of the equation is the printer design. Those printers where the hot end is at the top of the enclosure make it easier to achieve higher temperatures because the hot air rises to the top, and the vertical hot end position is fixed. Those printers with the hot ends at the bottom will always have more problems managing temperature simply because the temperature is more likely to vary as the hot end goes from the bottom to the top of the enclosure.

Let Us Help

If you're looking to achieve a particular temperature with your enclosure, let us know, and we'll give some advice on how to manage, but it's not that hard:

Lower Temperature = More Cold Air

Higher Temperature = Less Cold Air

Pro Tip: measure your current temperatures before attempting to make any changes. We get support calls saying "my enclosure is too hot" or "too cold," but they didn't measure the temperature. Without measurements, it's impossible to tell if a printing problem is temperature-related or not.

11. Tips and Tricks

On some surfaces the enclosure can slide around a bit. In those cases try using thin double sided tape on the corners to hold it in place.

Another issue is the magnets in the door are strong. You can either use two hands to open the door, one holding the enclosure and another to open the door, or reduce the affects of the magnet by adding a piece of black electrical tape to the side of the strike plate that contacts the magnet. You'll need to adjust the location of the magnetic latch by loosening the wood screws, moving the latch, and retightening.