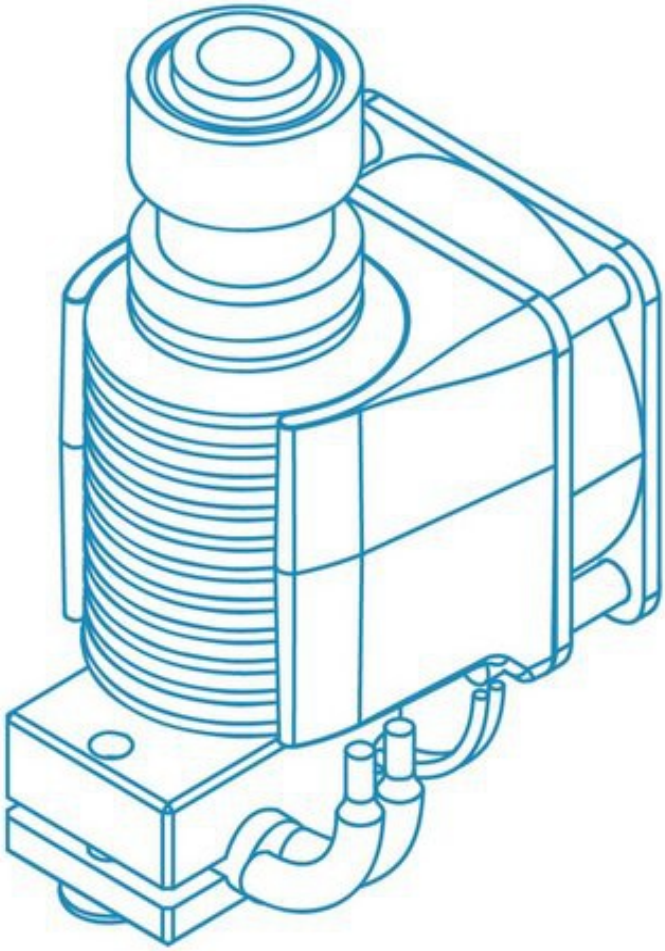
E3D V6 Assembly



This is a hard copy of the E3D notes to be found at https://e3d-online.dozuki.com/Guide/V6+Assembly/6?lang=en.

Introduction

V6 Assembly is easy, and we provide most of the tools you'll need. Please note, though, that you should be very careful of the following safety cautions:

Be aware of your electronics. Don't work on your printer while it is plugged in or turned on.

Be aware when you heat up your new hotend not to burn yourself on the heater block nozzle or heater cartridge.

The standard V6 is capable of printing up to 285°C, do not exceed these temperatures unless you have replaced the Thermistor cartridge with a PT100, the Aluminium heater block with a Plated copper heater block, and the Brass nozzle for a Plated copper, Hardened steel or Nozzle X.

Firmware modification is not optional it is a mandatory step,

Make sure you have ordered and received the correct voltage heater and fan to match the power supply of your printer. All of our current heater cartridges should have the voltage and wattage laser engraved on the cartridge. Taking an ohm reading is the most reliable method of testing what voltage/ wattage you have received.

Connecting 12v parts to a 24v power supply can result in overheating, component damage, or fire. If you are unsure double check the rating on your power supply.

Your HotEnd and your printer are your responsibility. We cannot be held responsible for damages caused by the use, misuse or abuse of our products.

Tools

- Multimeter
- Hex Wrench
- Screwdriver
- Nozzle Spanner
- x1 Adjustable wrench

Parts

- V6 Heatsink
- V6 Heat Break
- V6 Heater Block
- V6 Nozzles
- Thermistor Cartridge
- Heater Cartridge
- 30mm Fan
- Plastic Screws× 4

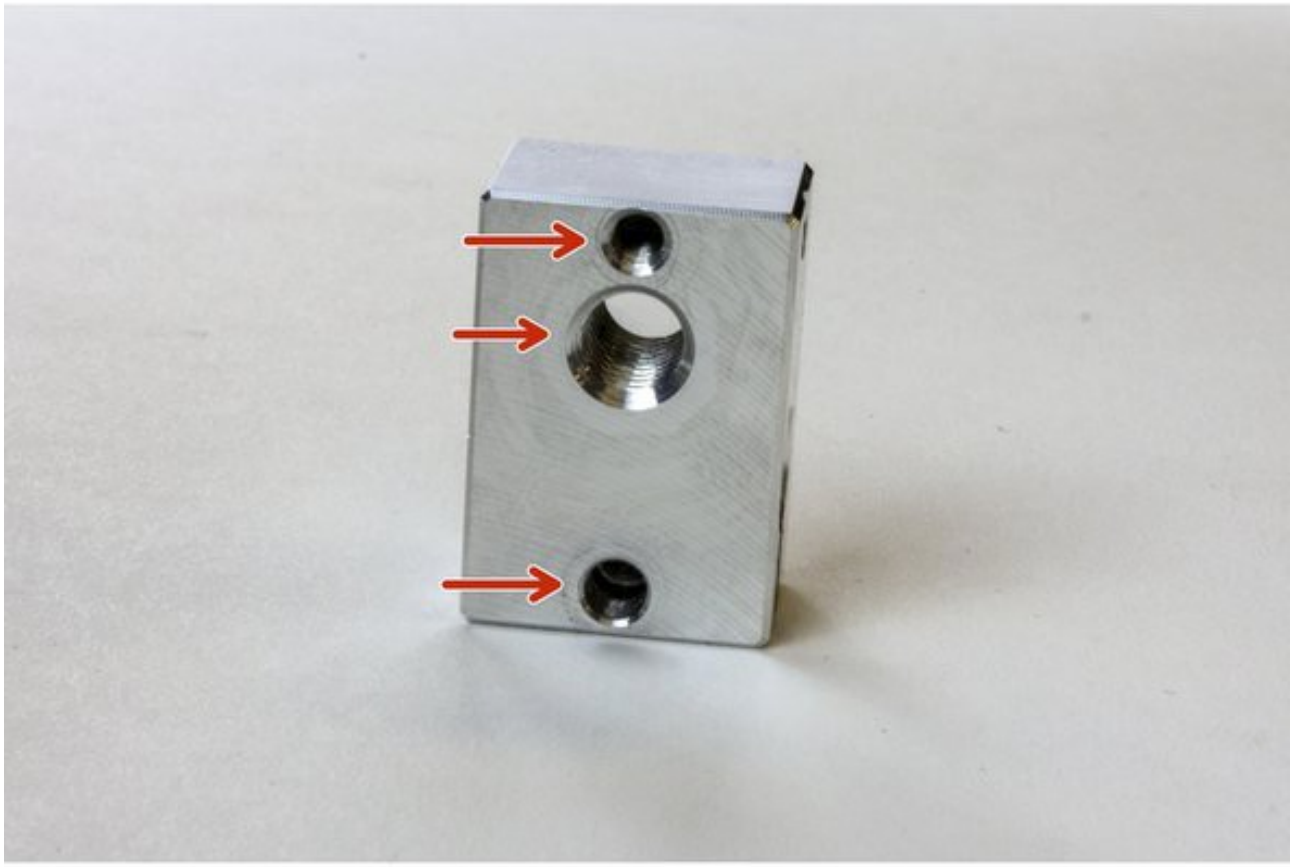
- M3 Grub Screw
- Fan Duct
- M3x10 Socket Dome Screw
- V6 Silicone Sock
- Collet
- Collet Clip
- Silicone sock
- PTFE Tubing

Step 1 Gather Parts

You'll need the following parts:

- Heater Block
- Nozzle
- Heat Break

Step 2 Orient your Heater Block

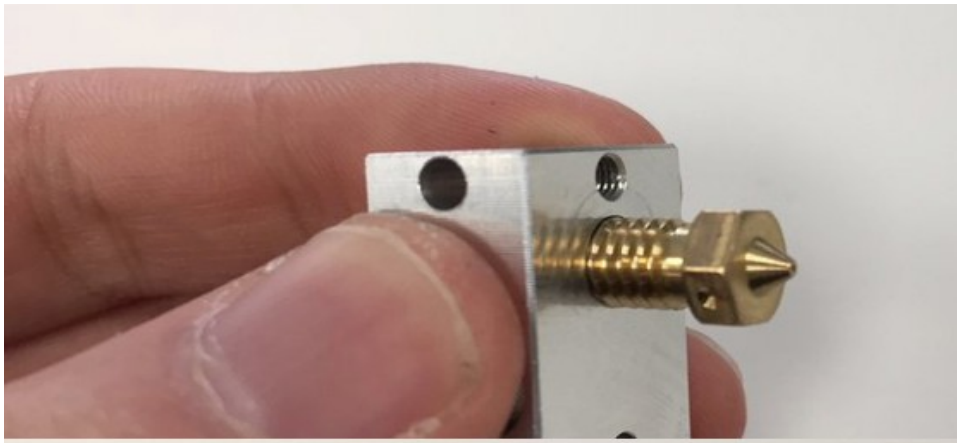


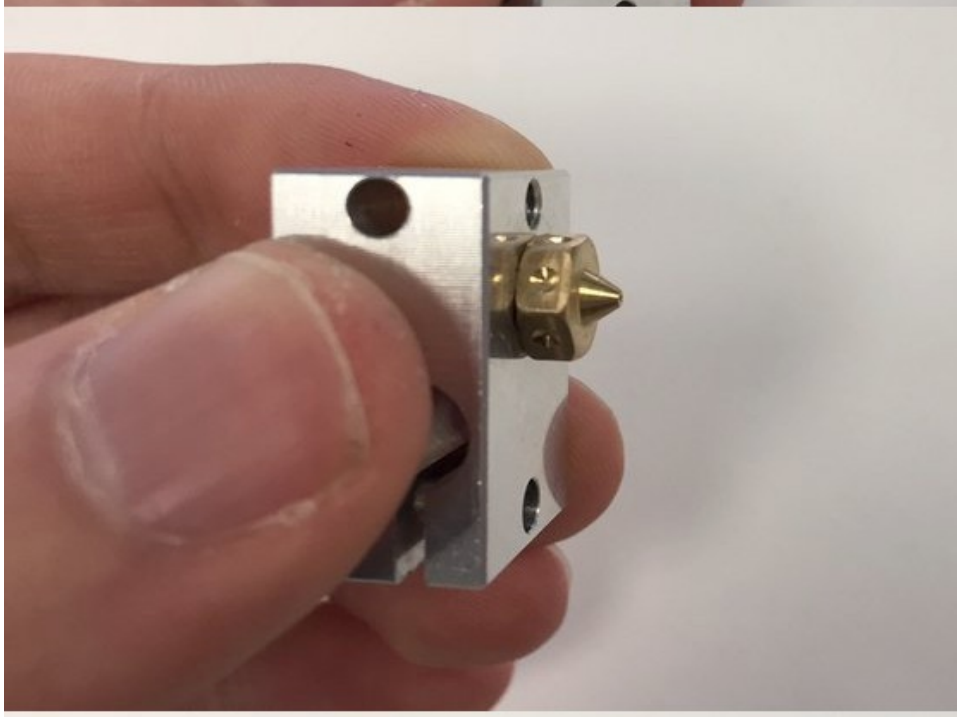
Before starting work on your heater block, make sure that you're going to screw your nozzle into the correct side.

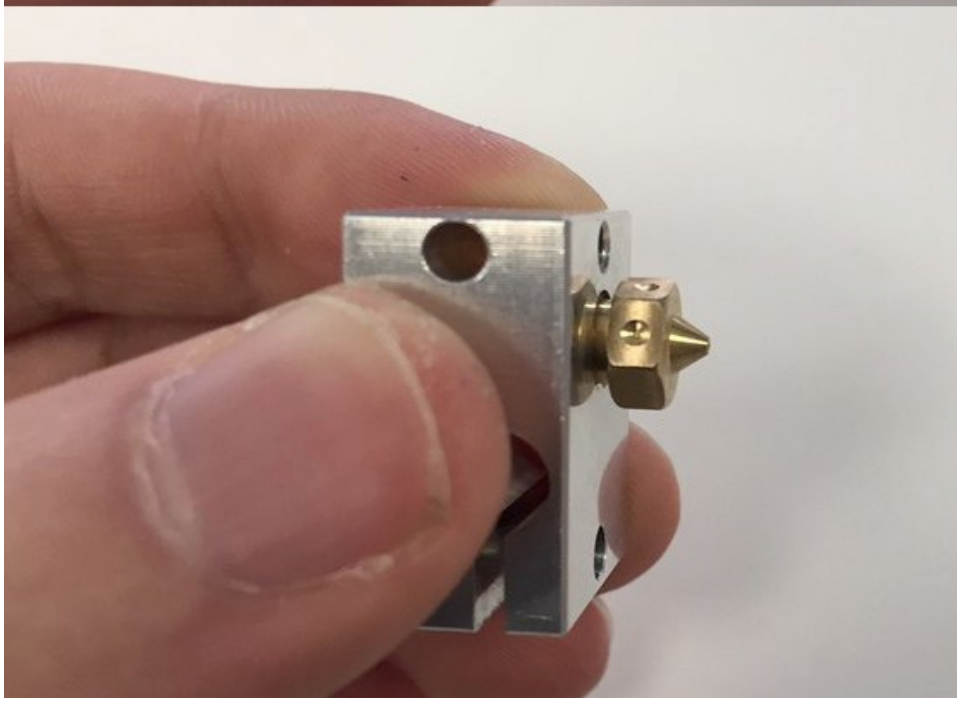
You should be looking at the side of the heater block with three holes in it.

Be aware that if you do install the nozzle the wrong way you won't be able to clamp the heater cartridge.

Step 3 Screw in Nozzle







Screw in the nozzle all the way into the heater block. Don't worry about tightness yet.

Then, unscrew the nozzle a full turn. This will leave a little space to tighten after screwing in the heat break.

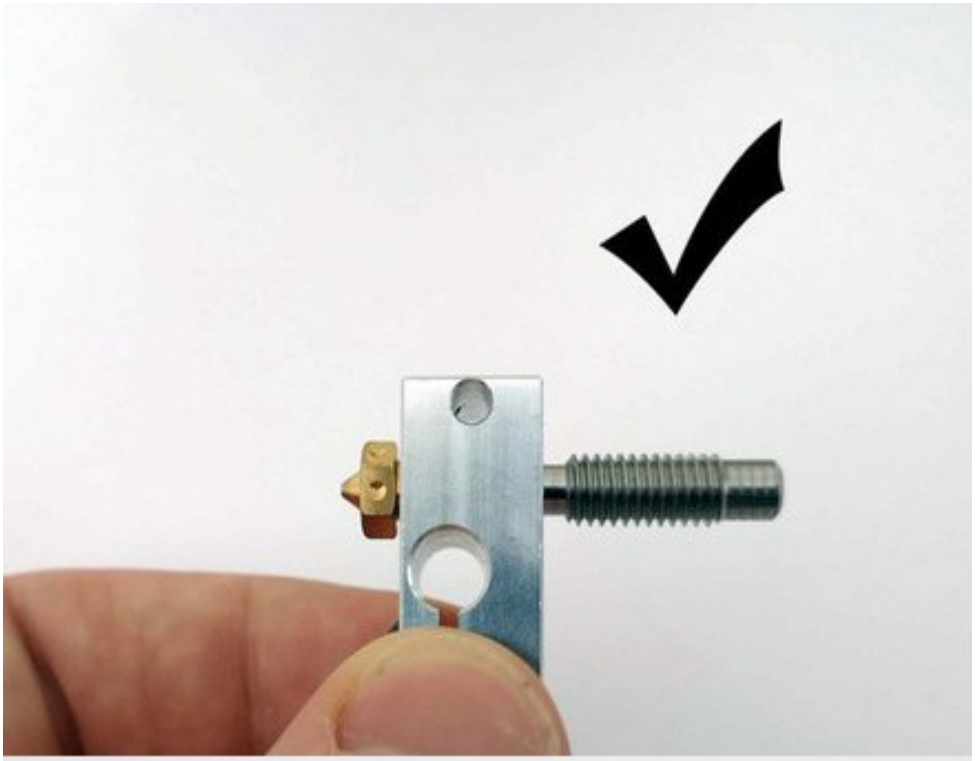
> ***Comments:***
>
> *While reading the info for the copper nozzle and block, I came across this from the copper nozzle page: "Combine with our plated copper blocks for the ultimate extrusion pairing. No need for hot tightening, this pairing just works."*
>
> *There's no mention of that here, or anywhere else that I've been able to find. Is it still recommended to do the hot tightening when you have both copper nozzle and block?*
>
> *Also FYI, this guide says to unscrew the nozzle a full turn, but the Heater Block Metal Assembly guide says 1/4 turn.*

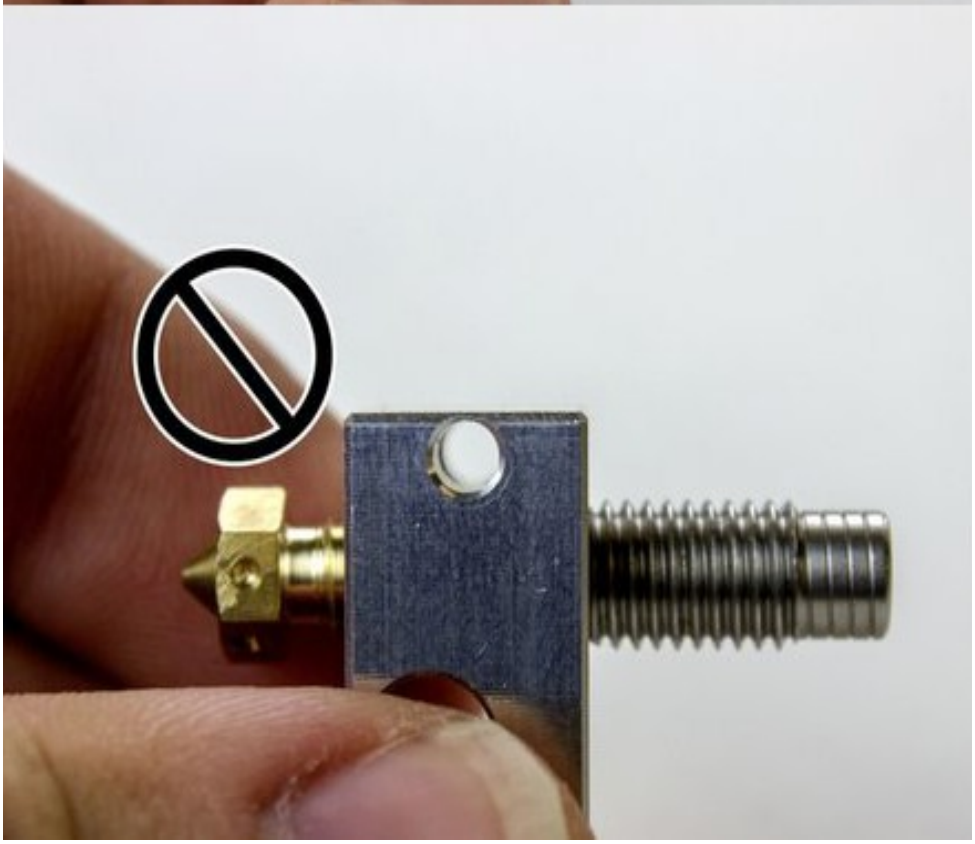
Step 4 Screw in Heat Break

Screw in the heat break until it touches the nozzle.

Tighten the nozzle against the heat break. No need to over tighten, we'll be hot-tightening later.

Step 5 Heat Break Check

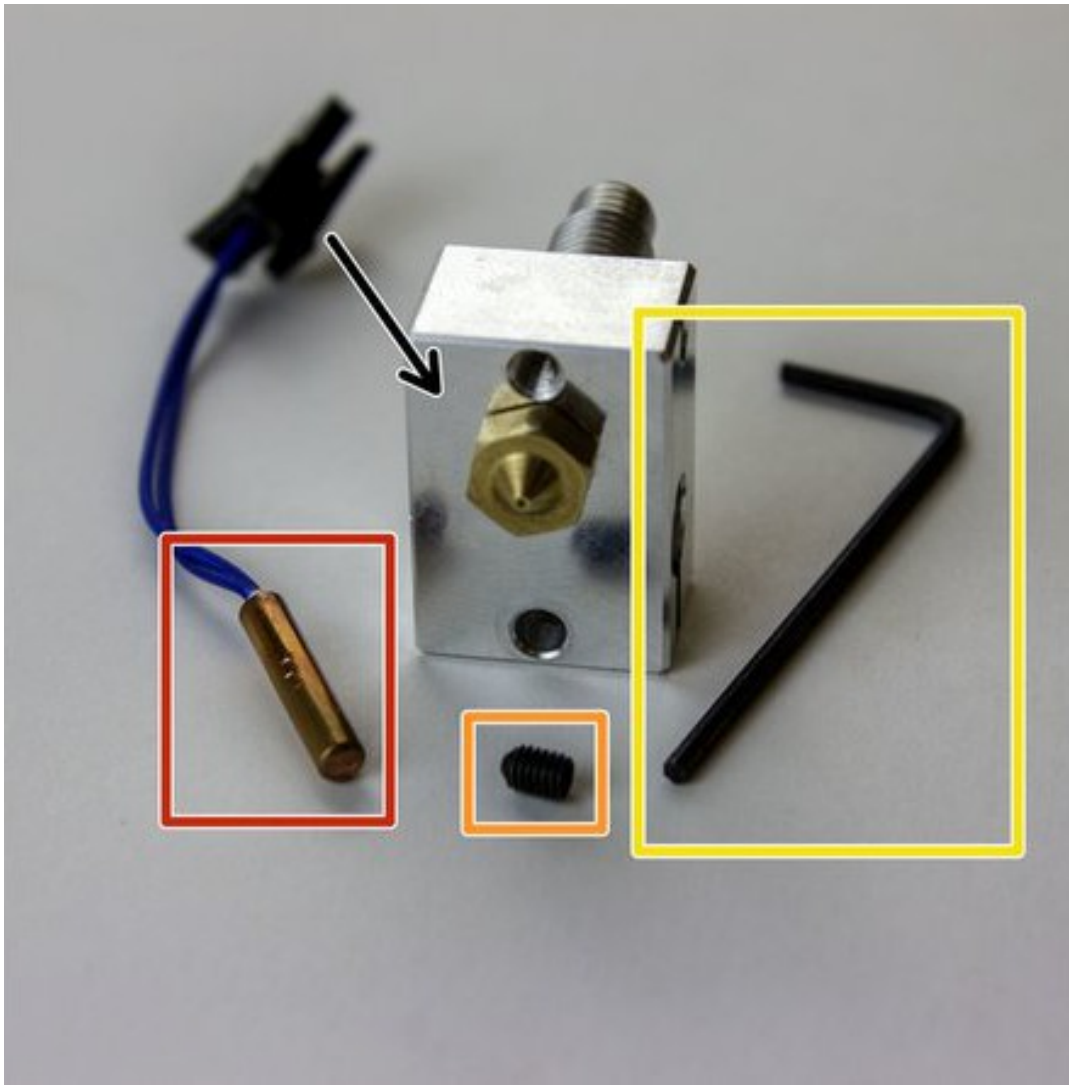




Double check that your nozzle is still almost flush with your heater block.

If there is significant space between the nozzle top and the heater block you should re-adjust your nozzle and heat break to eliminate that space.

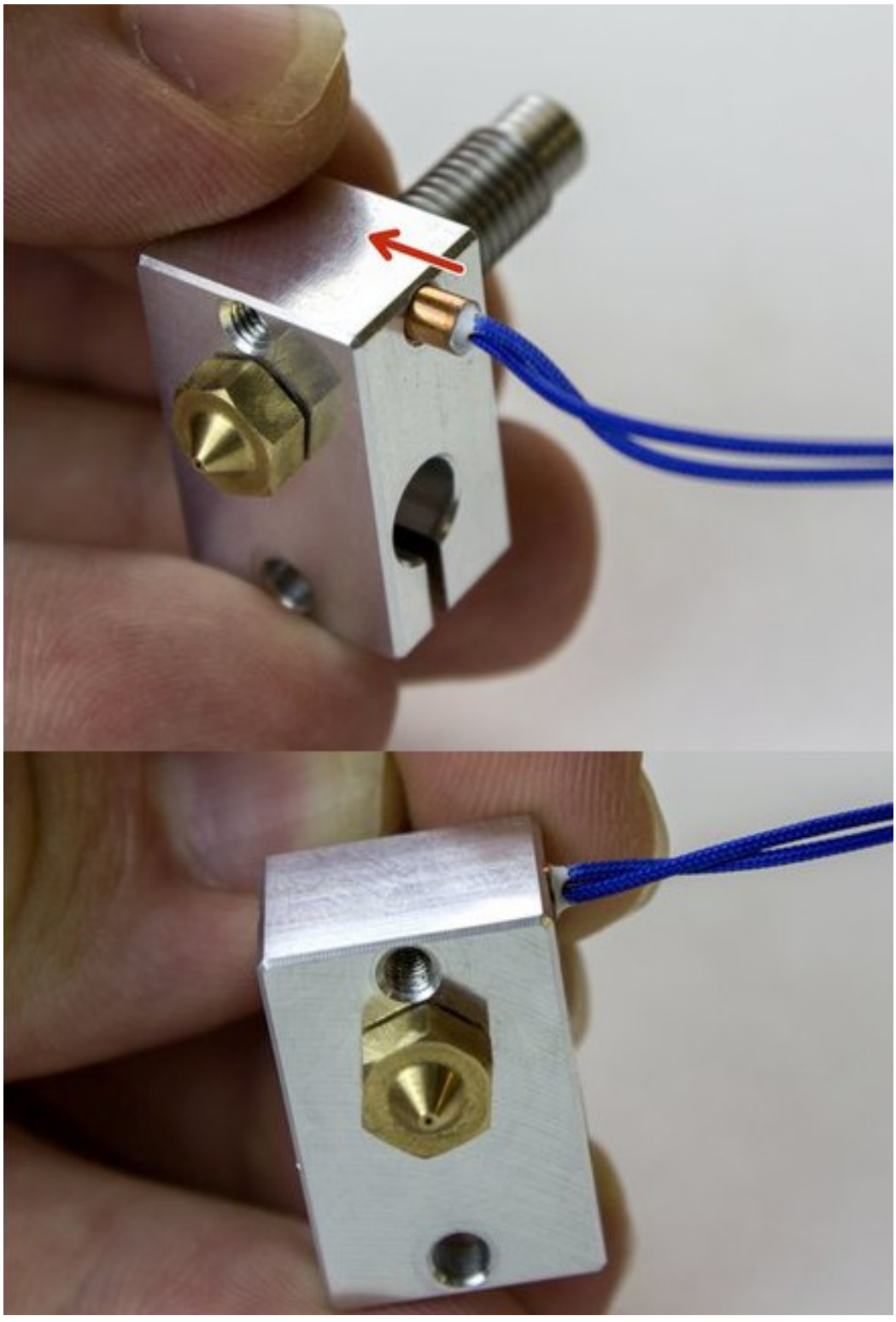
Step 6 Gather Thermistor Parts



Gather the parts you'll need to install the thermistor:

- Thermistor Cartridge
- M3 Grub Screw
- The Smaller, 1.5mm Hex Wrench
- Heater Block

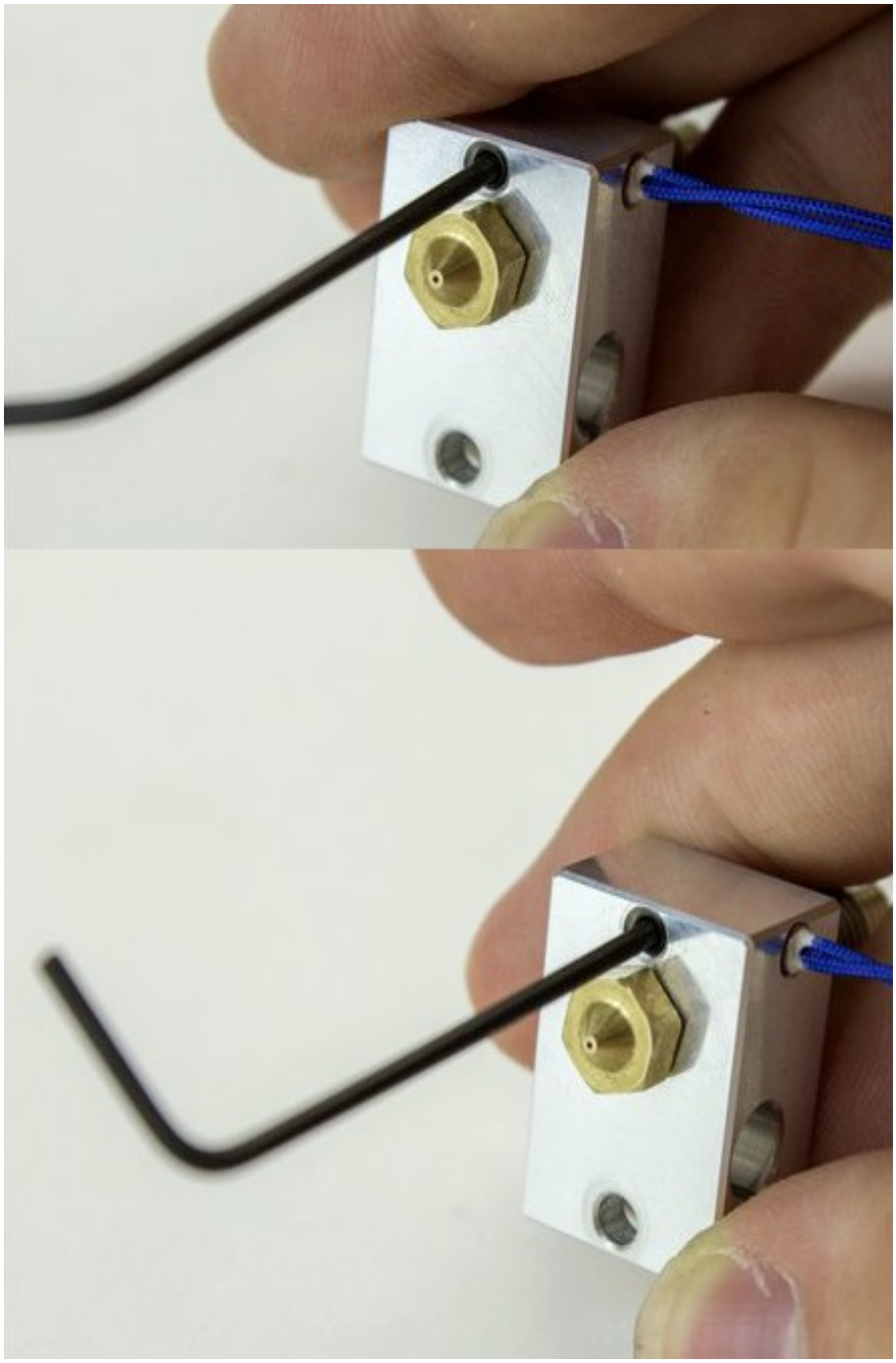
Step 7 Slide in Thermistor



Slide in the thermistor cartridge.

> You can slide the cartridge in either direction so that the wires extend from one side or the other of your heater block. Think about how you'll be organising your wiring to decide which makes sense for your printer.

Step 8 Screw in Grub Screw



Screw in grub screw until it just touches the thermistor.

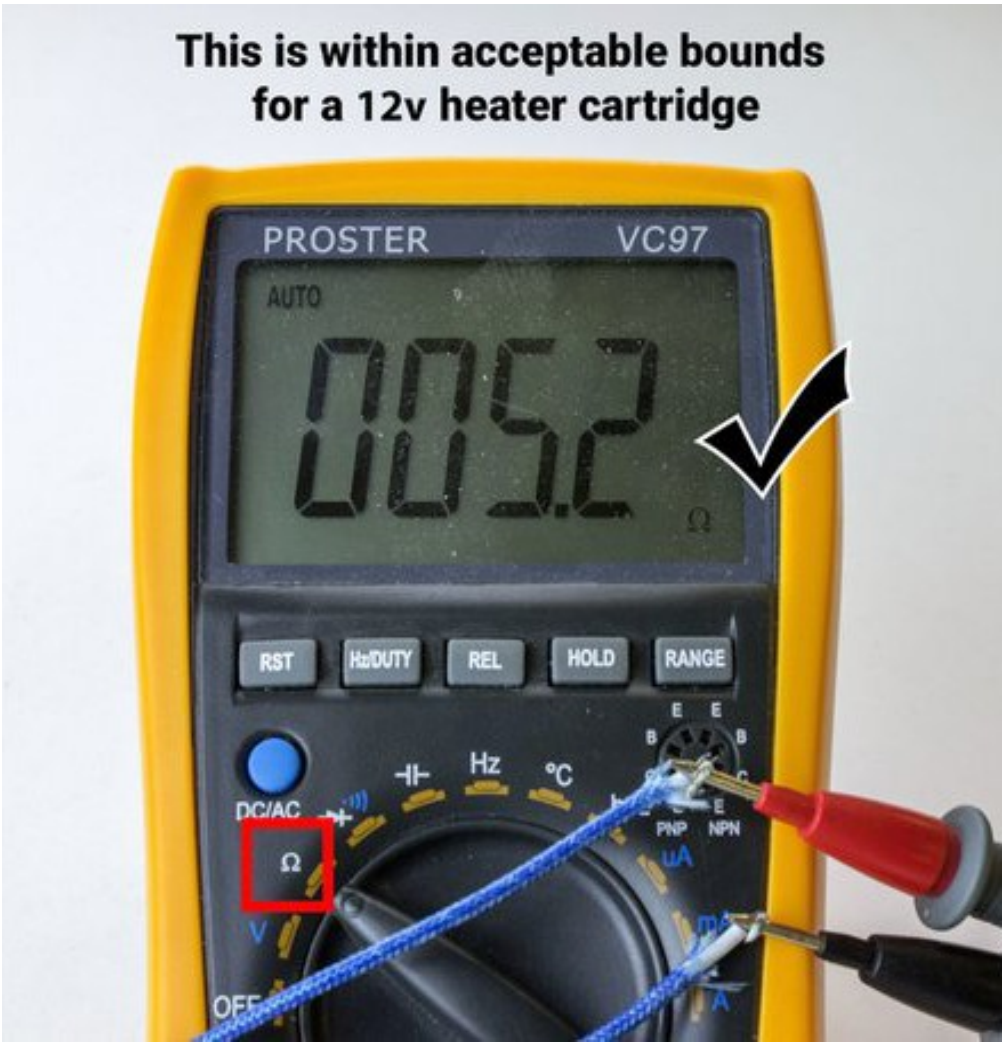
Tighten M3 grub screw by an 1/8 of a turn.

Do not over tighten the screw. The stainless steel thermistor cartridge is relatively soft, and you might deform it if you over-tighten the screw.

Deformation of the cartridge can make it difficult to remove at a later date.

Cracking of the potting ceramic resulting in poorer thermal response or in extreme circumstances, short circuit.

Step 9 Test Heater Cartridge



Before you install your heater cartridge, you should double check that you both purchased and received the correct voltage cartridge. Cartridges are laser etched with their voltage, but all it is worth double-checking anyway. *This process is less annoying than putting out a house fire.*

- If you have a 12v30w heater cartridge, your multimeter should read 4.8Ω
- If you have a 24v30w heater cartridge, your multimeter should read 19.2Ω

Your cartridges resistance may deviate slightly from these numbers, which is fine. We're mostly interested in verifying which cartridge type you have.

- If you have a 12v 40w heater cartridge your multimeter should read 3.6Ω
- If you have a 24v 40w heater cartridge your multimeter should read 14.4Ω

> ***Comments:*** *My heater cartridge does not have bare wires exposed as shown in the photo above. The wires are encased in a connector housing that is not accessible to the DVM probes. Suggest you show a photo of cartridges having this configuration and that you provide a recommendation/approach on how to make the required measurement.*
>
> *My 12v 30W heater measured 7.1 ohms, I'm not sure if my meter is calibrated, so I hope this is ok?*

You should include the readings for the 65 Watt heater cartridge.

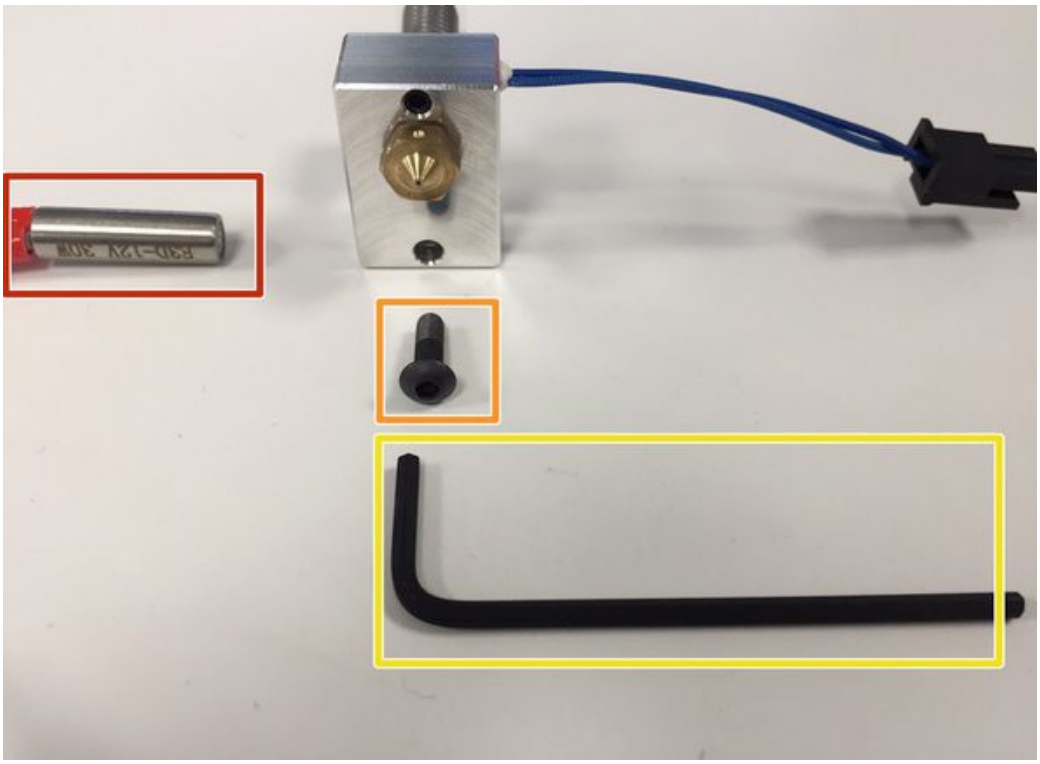
Guys, just use ohms law to calculate the expected resistance:

- *Resistance = Voltage * Voltage / Power*
- *e.g.*
- *12v 30w cartridge :*
- *R = 12 * 12 / 30 = 4.8Ohm*
- *if you measure 7.1 ohm, actual wattage is:*
- *P = 12 * 12 / 7.1 = 20 watt, the heating element is likely damaged and shall be replaced. (your meter will likely be out of cal for +/- a few percent, but measuring 7ohm from 5ohm is more than 40% out, that's unlikely, check the lead resistance, or better yet, apply 12VDC t, and measure current directly.*
- *For 12v 65w cartridge:*
- *R = 12 * 12 / 65 = 2.22ohm*
- *For 24v 65w cartridge:*
- *R = 24 * 24 / 65 = 8.86ohm*

I buyed a V6, but I was a mistake because I buyed 12 VDC V6 and my printer is 24VDC, when I test, the temperature go high very fast, I was happy but the fan has a lot of noise,when I tried to made the PID, I found a error,in this moment I saw my error, mi printer is 24 vdc and not 12, how I livein south america and is very expensive return v6 to E3d to change Itake of the heater and put the old heater and put a transformet 24 to 12 vdc to use the Fan, please, check your voltage before to buy.

Very confusing. You show testing the "heater cartridge" right after fitting the thermistor cartridge and you show both as having blue woven wires. I mistakenly thought that you had moved on to test the thermistor cartridge rather than the heater cartridge - which is shown in the next picture as having red cables.

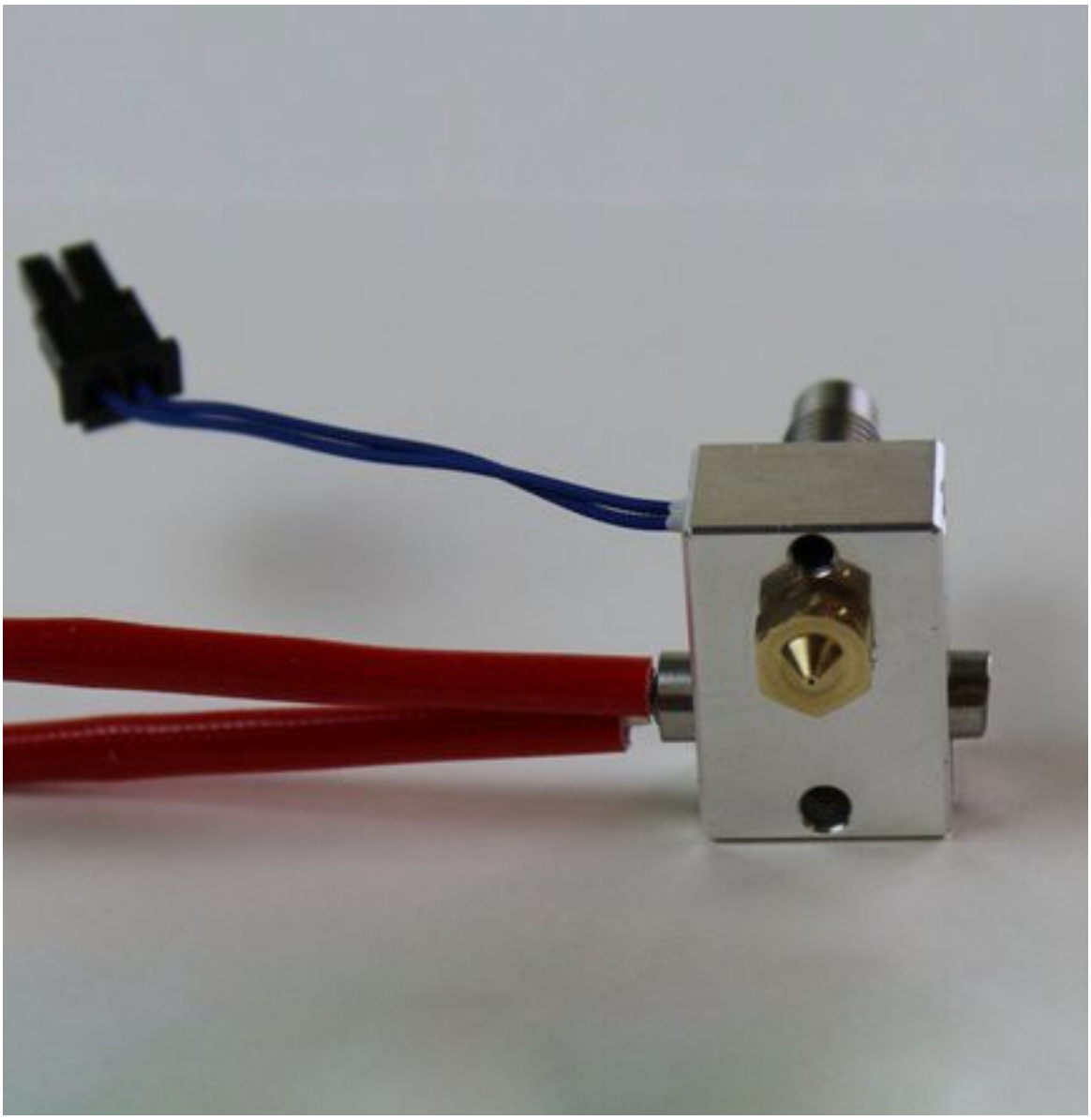
Step 10 Gather Heater cartridge Parts



Gather the parts you'll need to install your heater cartridge:

- Heater Block
- Heater Cartridge
- The Larger, 2mm Hex Wrench
- One of the longer, M3x10 Screws

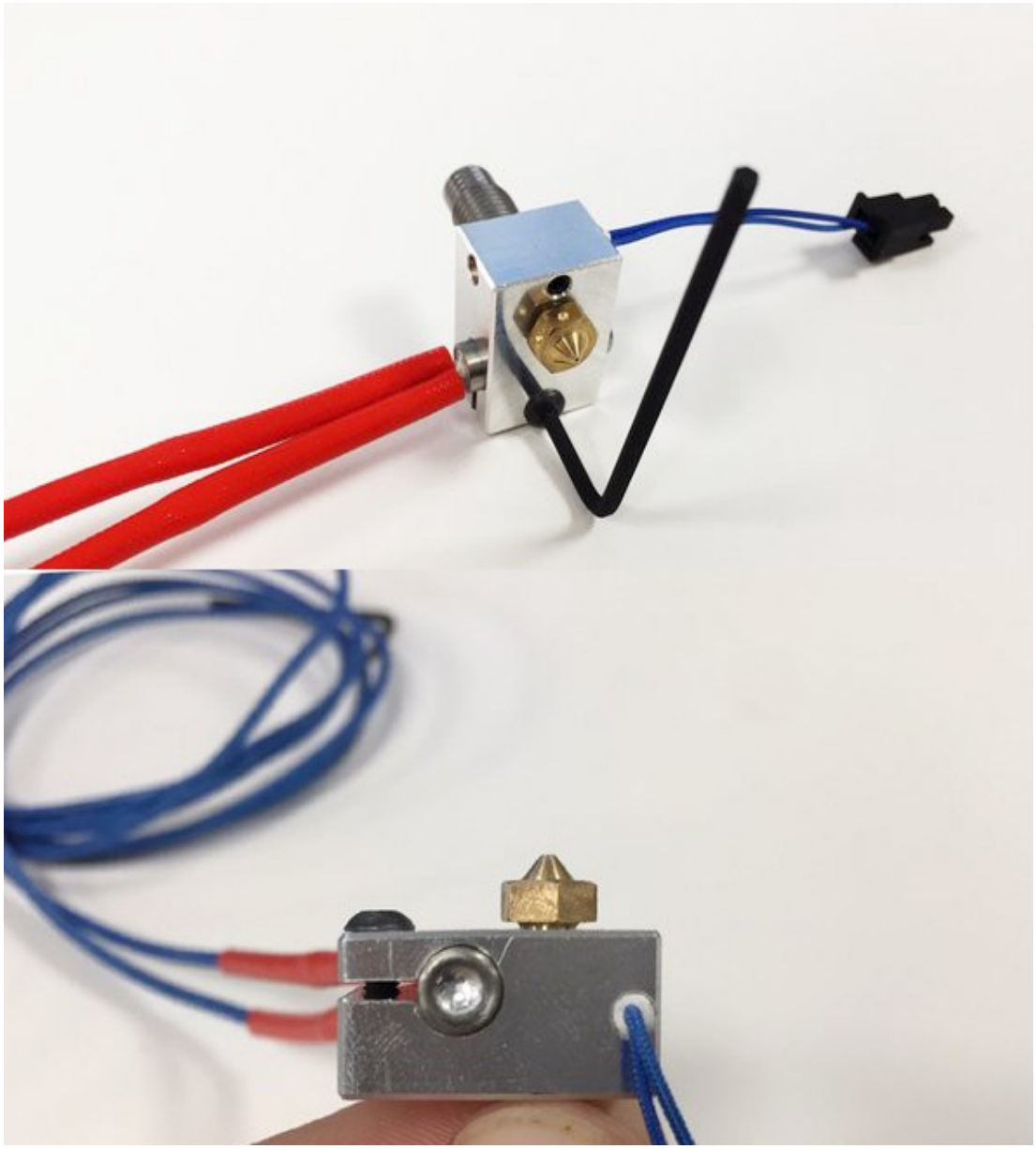
Step 11 Slide in Heater Cartridge



Slide in the heater cartridge. Typically you'd want the wires to come out the same side as your thermistor wires.

It's fine if the cartridge protrudes a bit from both sides of the heater block.

Step 12 Screw in M3 x 10 Screw



Tighten the M3 x 10 socket dome screw with 2mm hex key until the clamp deforms slightly (as shown in the second picture).

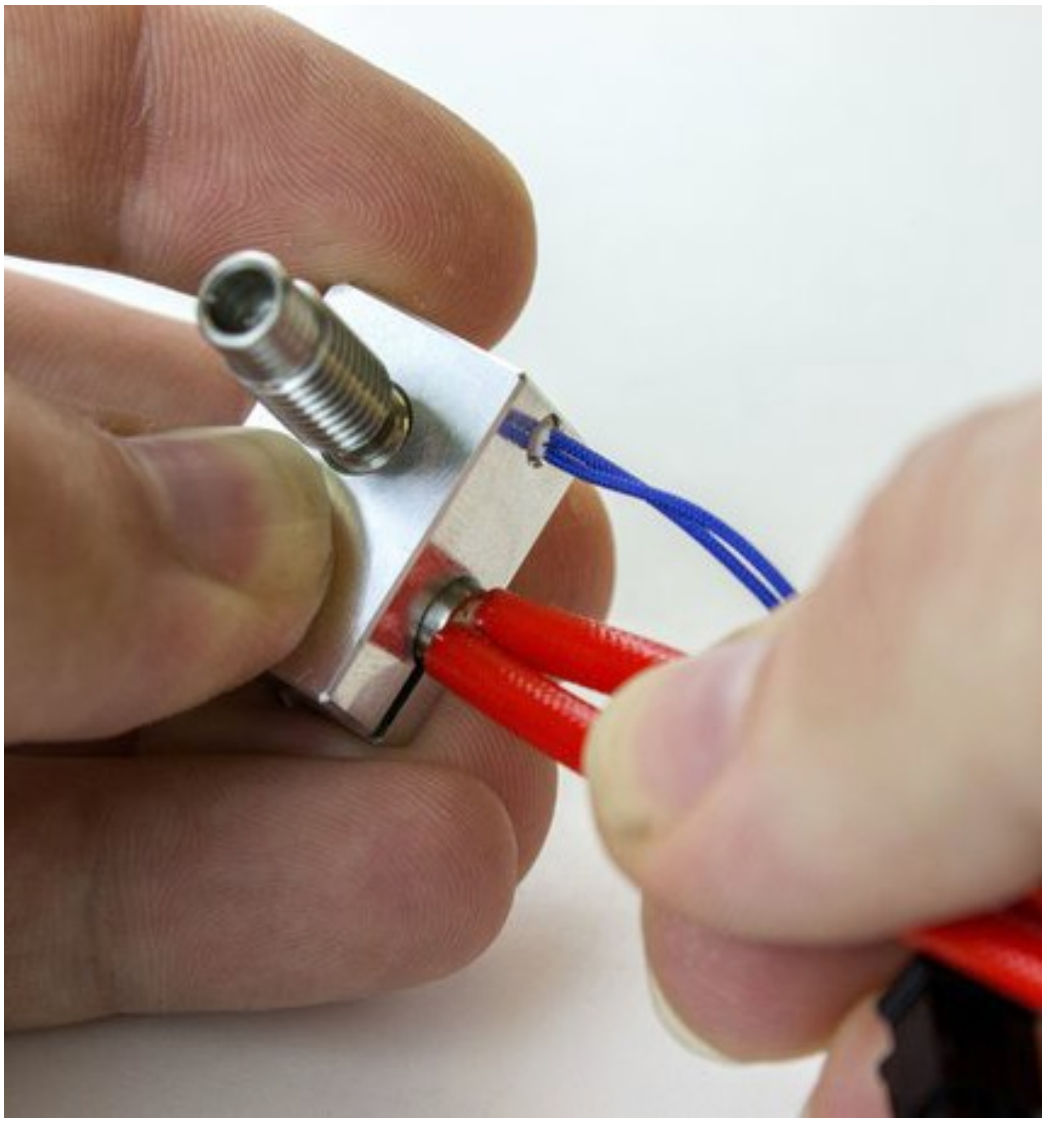
Comments:

There is no washer. It's just a button head bolt.

The current versions of the V6 kits don't use a washer you can proceed without one, thank you for the heads up I will update this section.

The picture contradicts the picture in the previous step a little by having the heater & thermistor wires on opposing sides.

Step 13 Tug Test



Before moving on, gently tug on your thermistor and heater cartridge wires. We don't want them slipping out during a print!

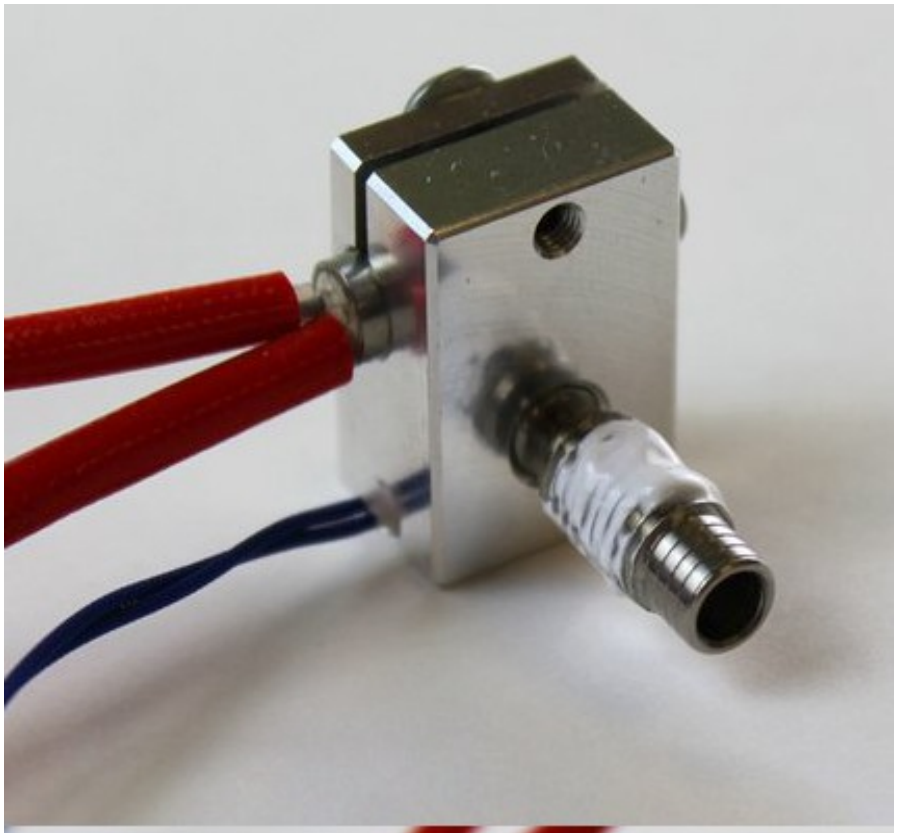
Be careful the thermistor wires are very fragile if you tug too hard it will cause damage to the thermistor.

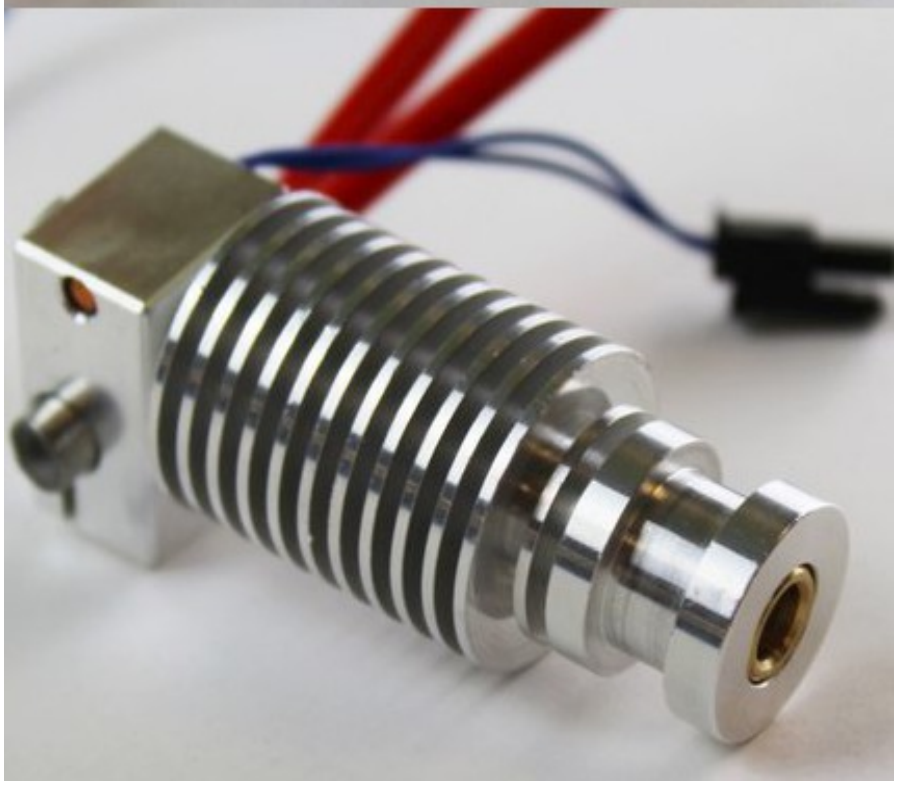
Step 14 Gather Parts for the Heatsink

Gather the following parts:

- Heater Block
- Heatsink
- Thermal Paste Sachet (not pictured)

Step 15 Apply Thermal Compound





Apply thermal compound to the thread of the heat break. You don't need to use the whole sachet.

After you're done, screw in the heatsink. It only needs to be hand-tight.

Don't use any thermal paste elsewhere on your hotend

Wash your hands once you're done working with the paste

Comments:

On the overall assembly of nozzle, heater block, heat break and heatsink, it seems important that (a) the nozzle tightens against the heat break not the heater block (for sealing) and (b) minimal heat is transferred from the heater block to the heatsink. So, that is why the nozzle must be backed off just enough so that when tightened down it still does not tighten against the heater block, there must be a gap between the heater block and heatsink, and there should also be no thermal compound between the two.

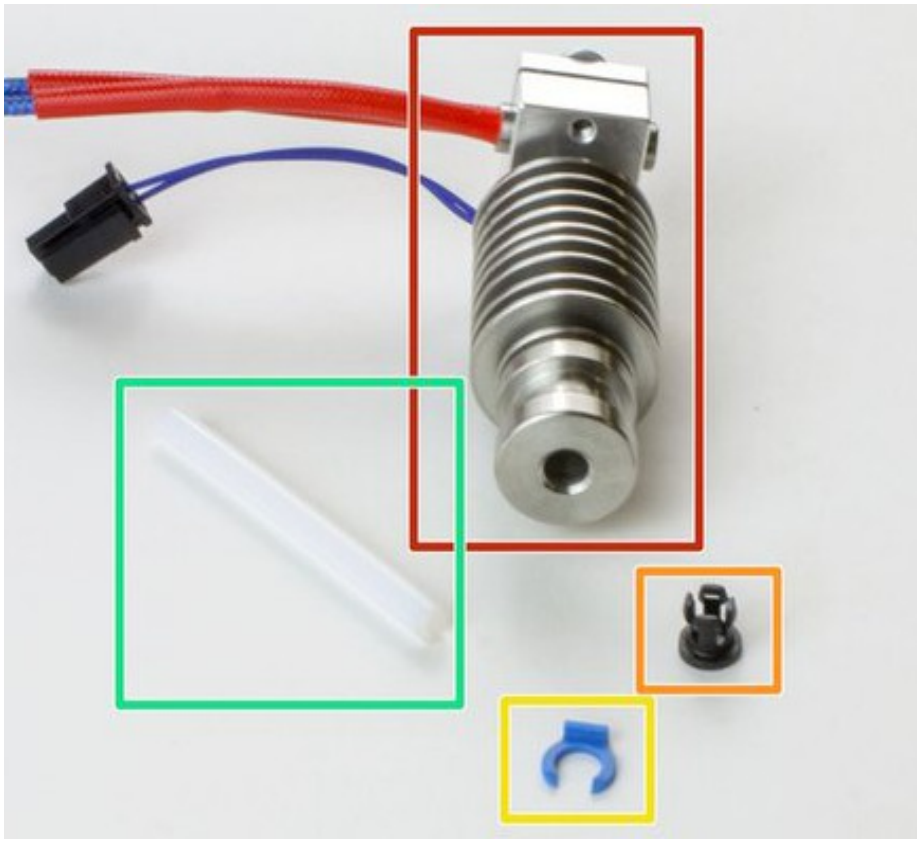
This photo shows the bottom of the heat sink in contact with the heater block, but the next one shows a gap between them. Which way should it be?

> *This is just a trick of the light in this photo: you **should** have a gap between the heater block and the heatsink. This little gap was what you verified in step 5.*

Thermal paste? I don't remember receiving any with my EV6 order. Can I do without it?

> *Sorry to hear your kit was missing thermal paste, if you contact support@e3d-online.com we will arrange to have a replacement sachet sent out to you. Alternatively, if you have any CPU thermal paste lying around that would also be a suitable choice. Not using thermal paste will risk issues with heat creep.*

Step 16 PTFE Tubing



Gather the following parts:

- Assembled Hotend
- Collet

- Collet Clip
- PTFE Tubing (at least 70mm long)

Step 17 Insert Collet

Insert the small black collet into the top of the Heatsink, the side with the four small legs should push into the brass ring in the top of the heatsink with gentle finger pressure.

Comments:

For SV01 not clear. The black collet might not be needed, the blue clip (see later) definitely isn't. Without the blue clip, nothing is gripping the PTFE tube, so is the black collet needed at all? There is a cone shaped bit that comes from the extruder (see CRG notes later, and the tube must be cut to length to just fit in this, so it may be that the cone is what presses the tube against the heat break. Needs further checking.

This step is not required when using the E3D Titan Extruder in a Direct Drive configuration.

What is the thickness spec on the clip. My clip has gone missing. I need a replacement or substitute. 2 e-cilps appears to be too much.

I don't have a brass ring- just bare aluminium. Is that ok?

Yes, more recent versions of the V6 heatsink do not use a brass ring.

I received the small black collet and a 'adapter' for other types printers I think. It's a big black adapter that, I assume, can be used for an v5 version so it has the same mounting height. How can I remove the brass insert, or isn't impossible?

Step 18 Prep PTFE Tubing

To make sure that the end of the PTFE tubing that will sit inside your hotend is square and flat, cut a slice off with a very sharp knife (a craft knife with razor sharp blade is recommended for this).

You might also find it handy to put some filament in the tubing while you trim it. This can help

keep it round.

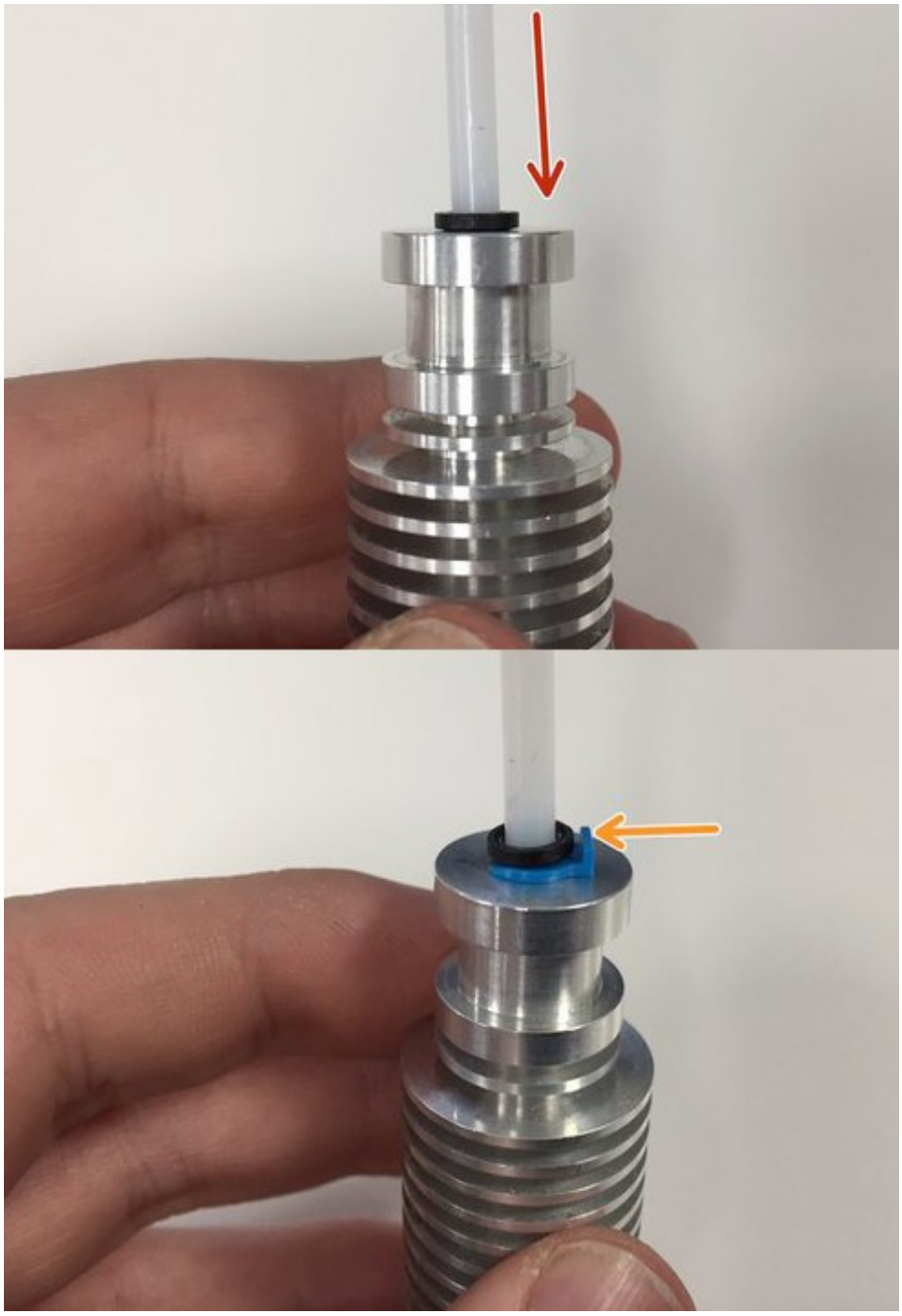
Comments:

The PTFE tubing is not included in parts list above. I suggest you add it with a photo. The reason for making this suggestion is that the tubing in my kit is blue, rather than white. I'm therefore not certain that this the correct tubing to use.

> *Thanks for the feedback, I've added PTFE Tubing to the parts list. I hope you got your confusion about the tube colour sorted out, but please contact support@e3d-online.com if you're still having trouble!*

Hello, Note that the PTFE for a Prusa I3 MK3S should be cut at a specific size. Please refer to Prusa I3 MK3 S documentation for that.

Step 19 Insert PTFE and Lock in Place



Insert the PTFE tubing all the way down until it reaches the top of the Heat Break.

Slide the collet clip in between the collet lip and the aluminium to lock the PTFE tube in place.

To release the PTFE tubing, remove the collet clip, press down on the collet whilst pulling out the PTFE tube.

Comments:

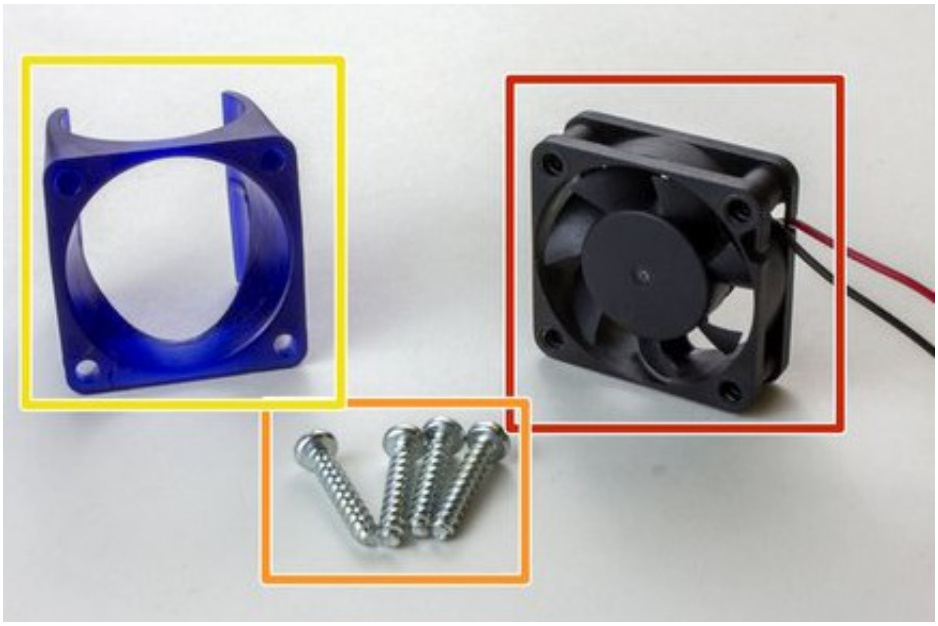
See previous comment in step 17.

This step is not required when using a Titan Extruder in the Direct Drive configuration - just push in the PTFE tubing and continue with the Titan Extruder guide.

The Step 17 and 18 I had ok, but I can't insert PTFE tube inside - Step 19, because there are too tight, the four small legs not allow to insert the tube. The tube inside is appr. 6mm only. Without Step 17, it's ok, the tube easy go inside appr. 30mm, 2-3mm in the screw. But in this case, the Collect clip and the Collect ring not place or grap. I have Bondtech dual drive direct Extruder and I think there not necessary the Collect clip and the Collect ring.

Its impossible to slide PTFE tube till heatbreak when collet clip is around collet. Maybe the clip should be added after tube is inserted?

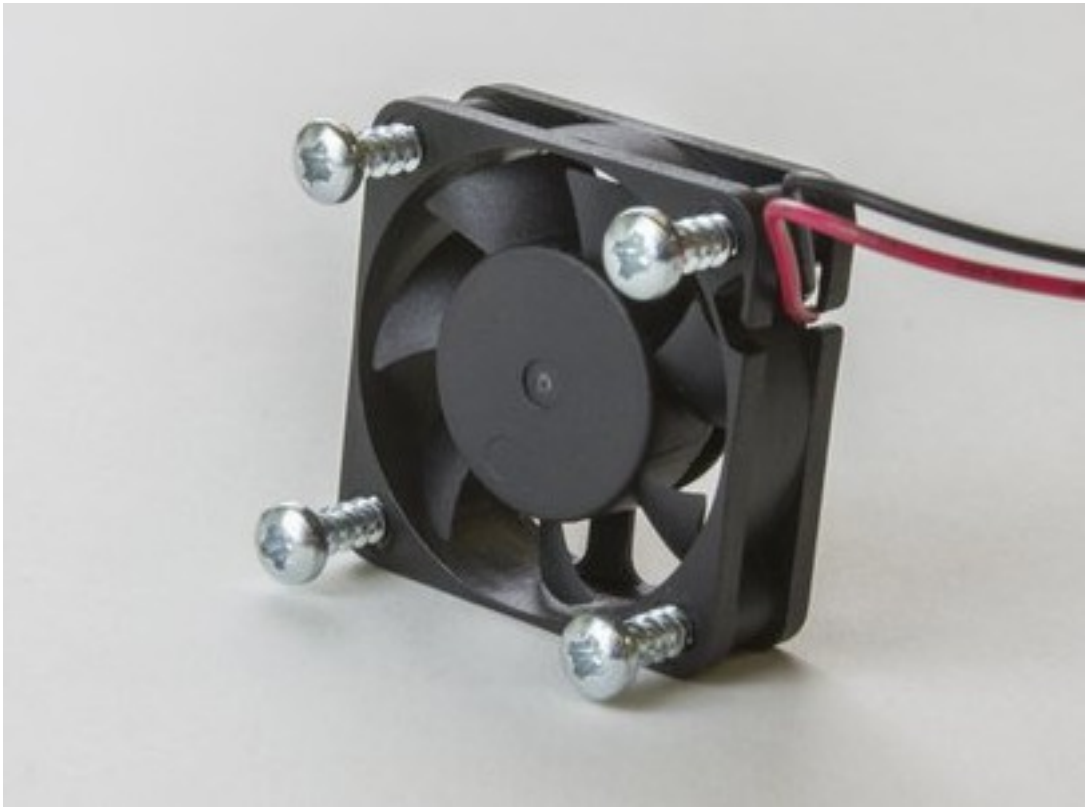
Step 20 Fan and Duct Parts



Gather the Following

- Hotend
- 30mm Fan
- 4 Plast-fast Pozidriv -head Self-tapping Screws
- Fan Duct

Step 21 Screw Plastfast Screws into Fan

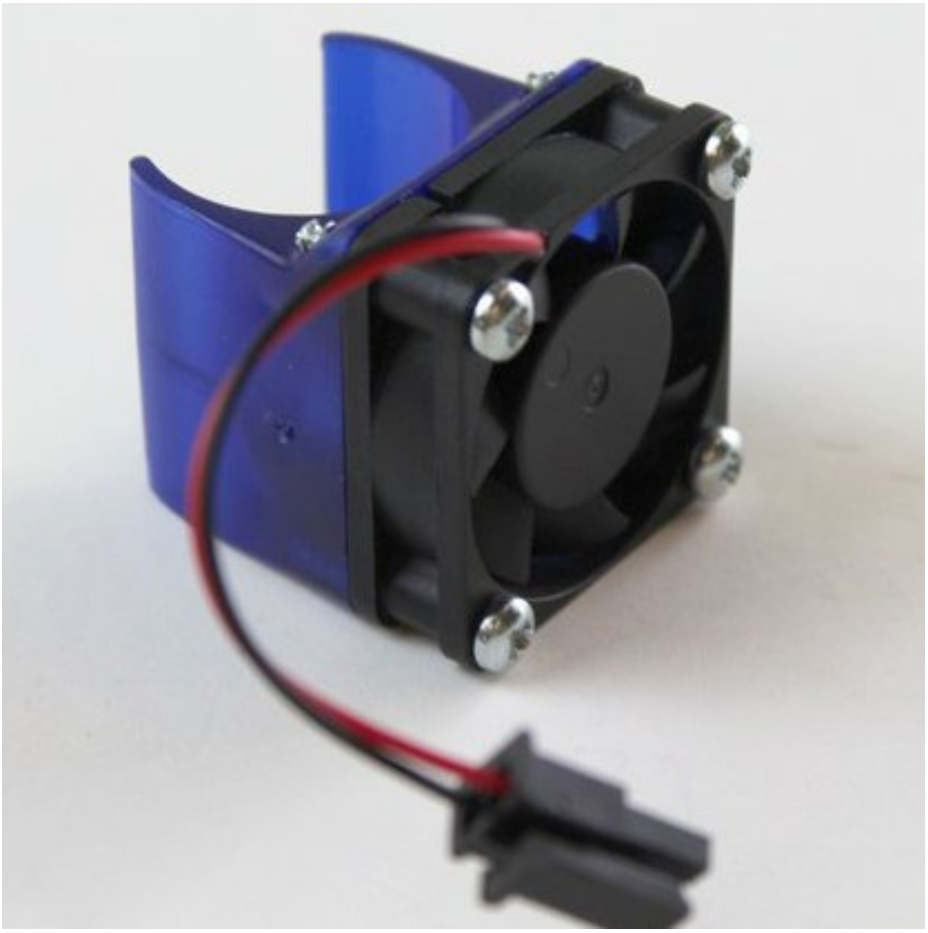


Make sure the screw heads are on the non-sticker side on the fan.

Screw the Plastfast screws partially into the fan.

The screws should not be sticking out of the opposite side yet.

Step 22 Screw Fan into Fan Duct

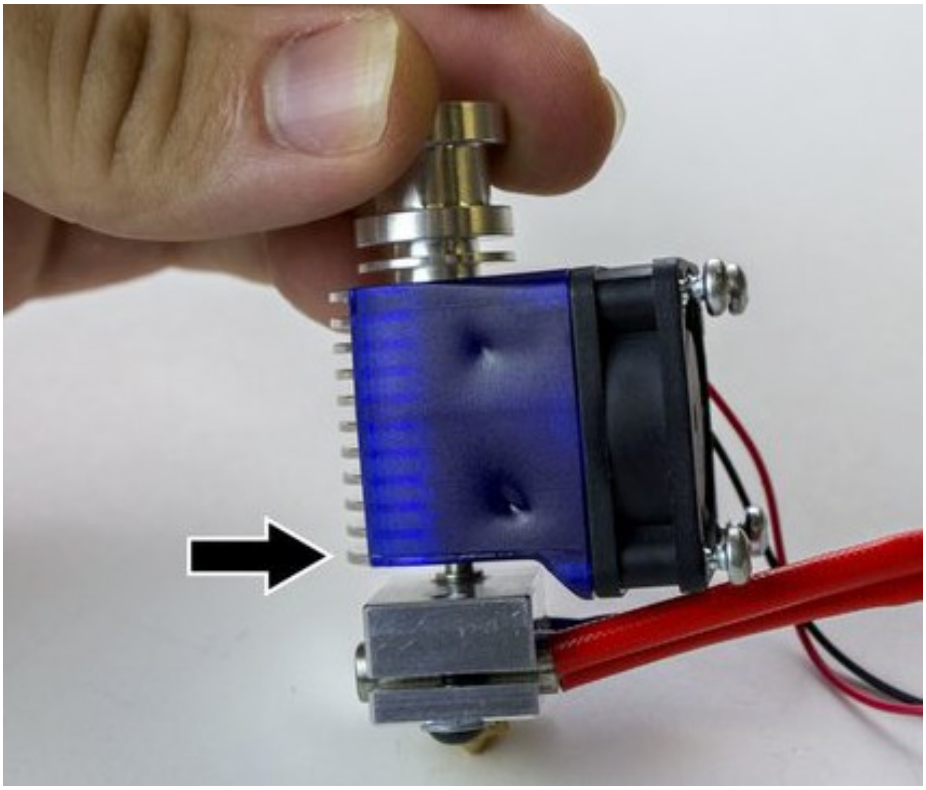


Think about where you want your fan's wires to come out before screwing it on. (You can mount the fan duct facing either way on your HotEnd)

Screw the fan onto the fan duct. You may require a lot of torque and will therefore need a well-fitting screwdriver.

Don't worry about getting the screws 100% tightened, you just need to secure the fan.

Step 23 Clip Fan Duct onto Heatsink

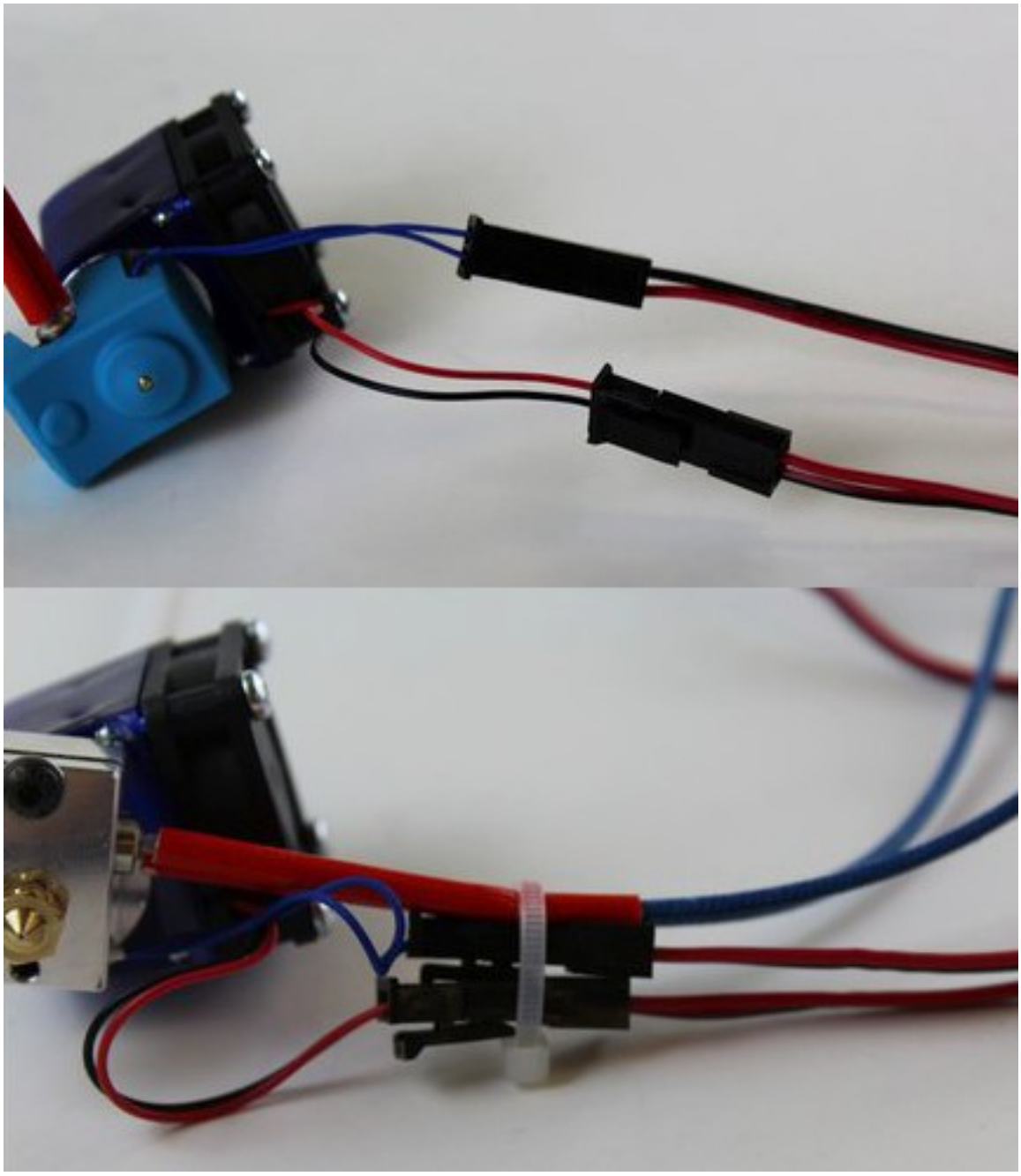


Clip the duct onto heatsink.

Make sure the duct covers the fin closest to the heater block.

The little over-hang can face up, down, depending on your setup.

Step 24 Connect Extension Wires



Plug the extension wires into your thermistor and fan. The other ends will go into your printer's electronics board.

> If you're replacing an old HotEnd, note where its wires were plugged in and mirror those for your new V6.
>
> If you're building a new printer, you may need to consult the documentation for your electronics board to see where to plug in everything.

Use the included cable tie to link the connections together for strain relief.

> Take a little while to properly organise your wiring so that it doesn't get snagged on any corner of your printer.

Step 25 Firmware

Configuring your firmware is different depending on the type your printer uses. Follow one of the links below for guides on how to update each of the most popular firmware. When you're done, continue in this guide.

Guide for Marlin firmware

This assumes knowledge of how to download and build Marlin.

Two separate builds of Marlin are needed:

- the first with an extra high max temperature to allow hot tightening at 285C
- the second being the version to use in normal printing with the max temp limited to 270C

See points below about setting it 15C higher than needed to set on LCD.

Thermistor settings

In the `configuration.h` file, find the Thermal Settings section. Below the comments you'll find the settings for the types of thermistors your printer uses. (Typically there will be one per hotend and one more if you have a heated bed.)

- If you're installing your V6 as your only hotend, change the first highlighted line to: `#define TEMP_SENSOR_0 5`
- If you're replacing an existing hotend or have multiple hotends, adjust whichever line corresponds to the tool number that you're changing (they start counting from 0)

Set maximum temperature

> While the metal of your new V6 hotend can withstand very high temperatures, your thermistor can only go up to around 285°C for extended (?? - limited) periods.

Set that as your maximum temperature by changing the first highlighted line to: `#define HEATER_0_MAXTEMP 285` (or adjust the line corresponding to the hotend you're changing).

> The max. settable temperature on the LCD is 15C less than the max temperature, you will need to set the max temperature to 300°C in the firmware in order to hot tighten at 285°C.
>
> Remember to change the max temperature back to 285°C after you have hot tightened.

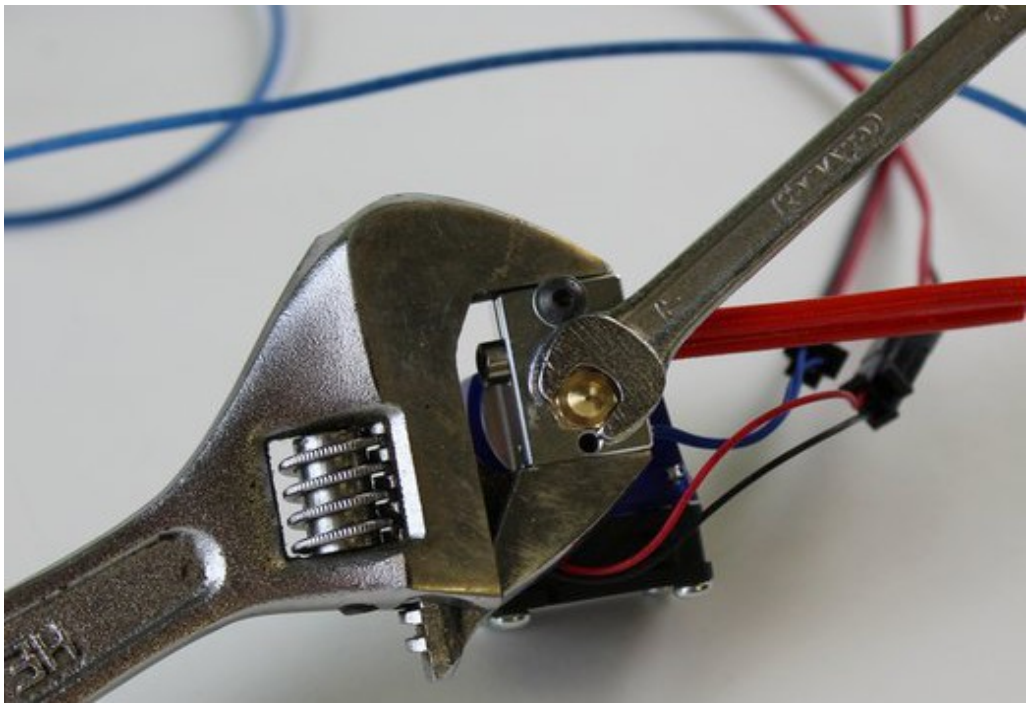
Set minimum temperature

For safety it is strongly recommended to make sure that your printer detects if the thermistor stops sending correct temperatures for any reason.

Set the first highlighted line to: `#define HEATER_0_MINTEMP 5` (or adjust the line corresponding to the hotend you're changing).

In newer versions of Marlin there are other features such as Thermal Runaway Protection that might be useful as well, though they are typically on by default.

Step 26 Hot-Tightening



Hot-tightening is the last mechanical step before your V6 is ready to go! Hot-tightening is essential to sealing the nozzle and heatbreak together to ensure that molten plastic cannot leak out of the hotend in use.

Using your printer's control software (or LCD screen), set the hotend temperature to 285°C. Allow the hotend to reach 285°C and wait one minute to allow all components to equalise in temperature.

Gently tighten the nozzle whilst holding the heater block still with a spanner and using a smaller 7mm spanner to tighten the nozzle. This will tighten the nozzle against the Heatbreak and ensure that your hotend does not leak.

You want to aim for 3Nm of torque on the hot nozzle—this is about as much pressure as you can apply with one finger on a small spanner.

Comments:

Must the fan be connected too in order to prevent over heating?

> *We **do** recommend plugging in the fan before doing this step, but as long as you let your heatsink cool down before loading filament you should be fine.*

I tried 3NM and it destroyed my aluminium block. I reduced it to 2NM which works fine for me as well.

3NM at temp also resulted in my aluminium block failing. Hardened steel nozzle started to tighten but then the threads on the block failed before reaching 3NM using a quality torque wrench. Now the nozzle can spin freely inside the block and plastic leaks between the block and the heat break when I attempted to use it.

Currently waiting for another block to arrive. I would advise people to not go above 2NM if using a torque wrench, it should be plenty when at temp.

As soon as I connect an adjustable wrench like that, the temperature falls. Will it

recover without damaging the heater if left long enough?

> *It's normal to see a temperature drop when attaching an adjustable wrench, it's acting like a heatsink. Try to reduce the amount of time the wrench is attached, ie without rushing do the hot tightening process as quickly as possible to maintain the highest temperature you can.*

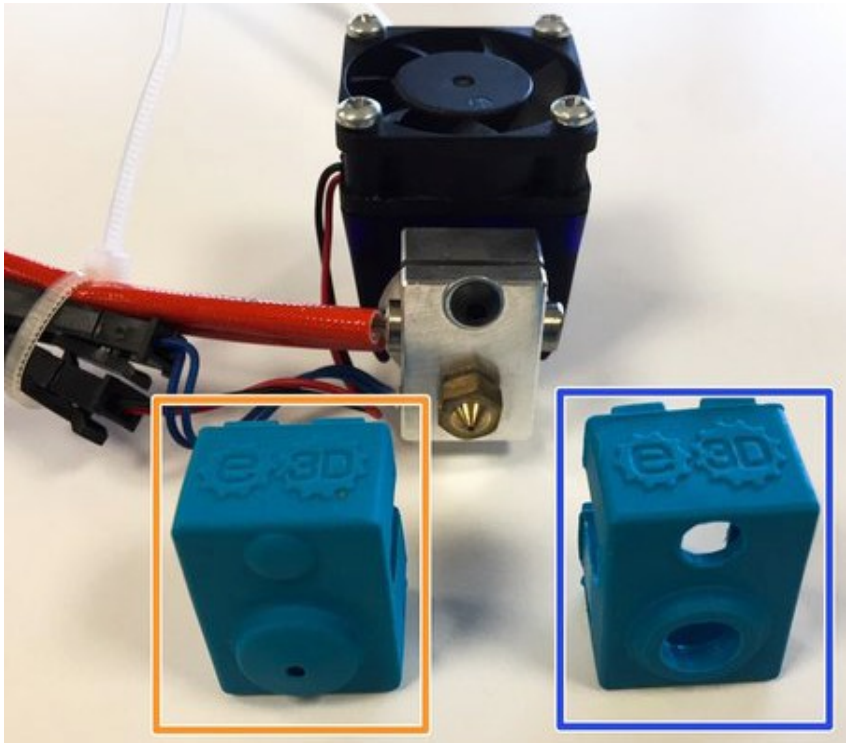
I had to clean my nozzle. So I had to take it out, and then after cleaning, I screwed it back in. I didn't do a hot tightening again. Of course, now I'm getting some molten plastic leak between the hex and the heater block. what do you recommend I should do?

Is there a comment from E3D regarding the torque ? It is suggested 3Nm but users do complain that it may destroy the block !

I'm doing this for first time. I didn't receive a ptfe tube or heatsink shroud to attach the fan to. I'm going to take advice from other users and not go over 2NM. I bought the replacement from Amazon a year ago and just now redoing the hot end on this machine.

The use of the term 'spanner' wrench is a bit off to me as well. That picture shows a adjustable wrench and an open end wrench. The pressure a 13 year old child could put on this with their 1 finger vs. Lou Farigno are between two extremes and the distance or size of the wrench has a huge amount to say about it as well?

Step 27 Gather Sock Parts



Gather the following:

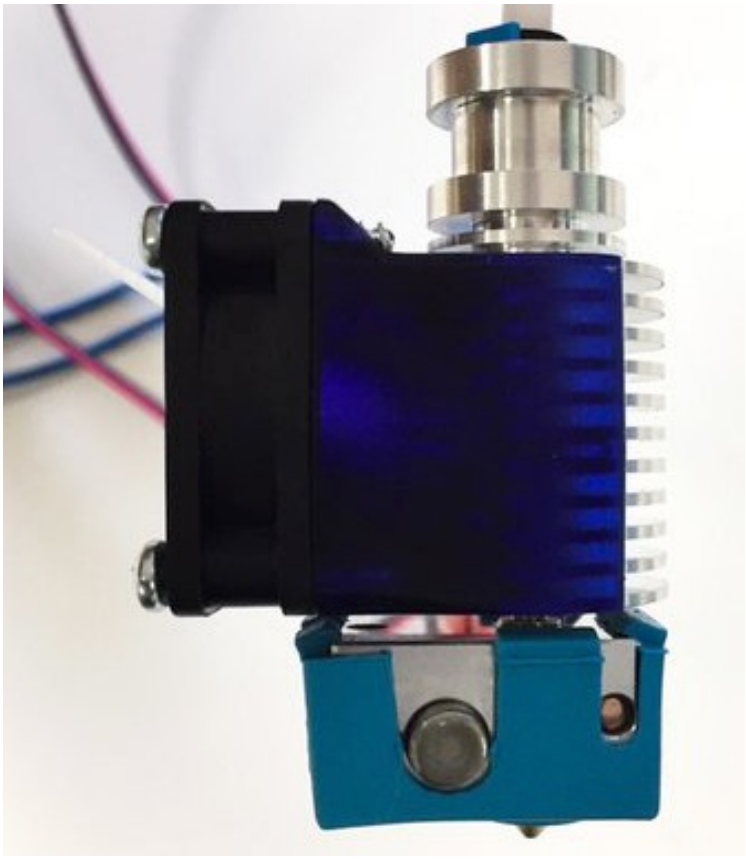
- Silicone Sock, one of either:
  - Pro Sock
  - Or Normal Sock

- Your HotEnd

Comments:

What is the difference if usage between the pro and the normal ?

Step 28 Attaching Sock

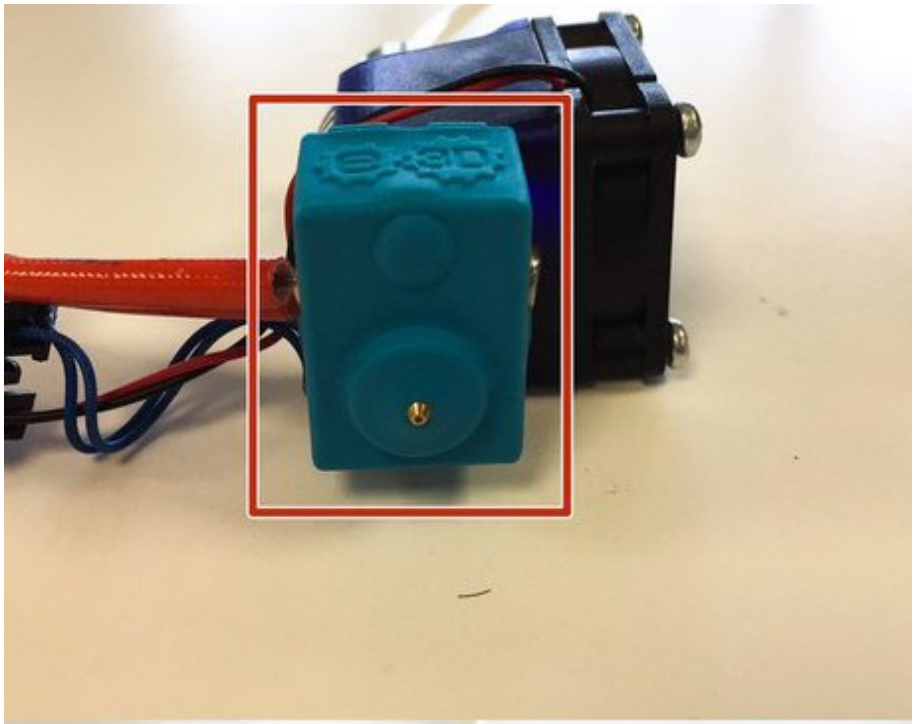


First, let your hotend cool down.

Slip your silicone sock over the hotend. Try to get each of the little clips on the top of the heat block so the sock will stay on better.

It may look like your sock doesn't quite fit. Don't worry, when you heat up your HotEnd, the sock will expand, and the clips will fit just fine.

Step 29 Final adjustments



If you're using the pro sock make sure that the tip of the nozzle protrudes from the sock.

If you're using a normal sock, it should look like the second picture when you're finished.

Step 30 PID Tuning

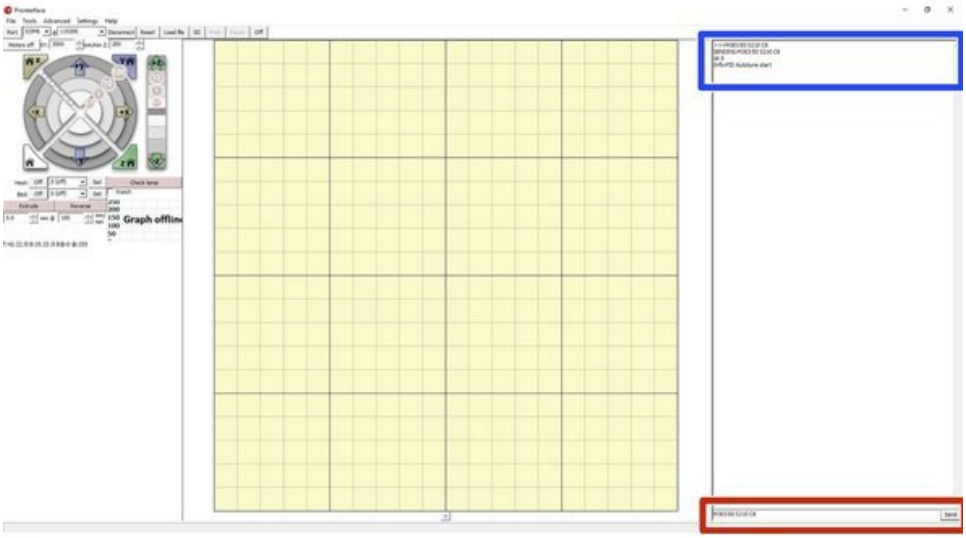
Whenever you install a new hotend, it's important to run a PID tune. This will allow your printer to adjust some internal parameters so that it can learn how your hotend heats up. This way, your printer can anticipate how much power it needs to give your hotend to get it up to temperature, but not over.

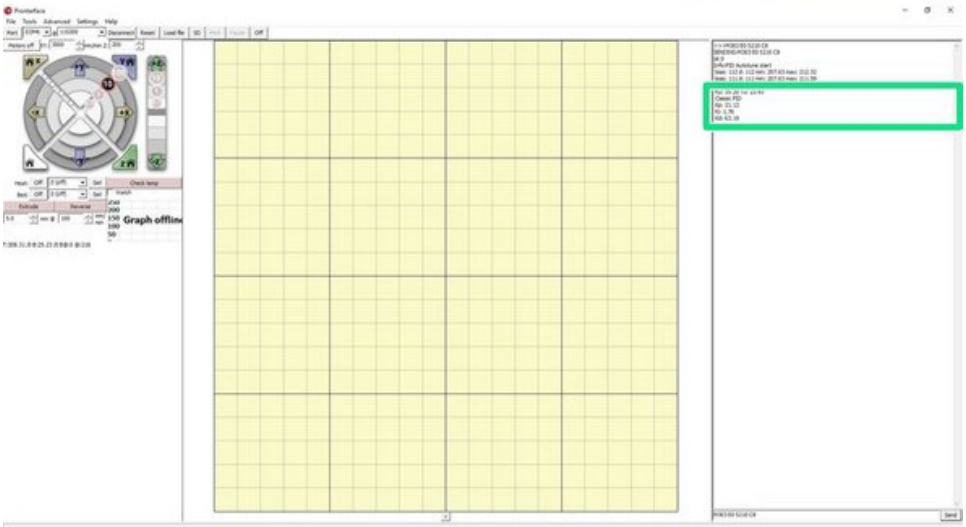
Use a computer to connect to your printer. If you have a typical RepRap printer, you can use PrintRun, Repetier Host, Simplify3D, or MatterControl.

Other, closed-source, p

rinters may be better suited to their manufacturer's recommended printer control software.

Step 31 Tuning with Pronterface





Make sure you have your hotend in a place where it can get hot without damaging anything or setting any fires! Mounted on your printer or held with a spanner will work fine. Take care not to touch your hotend when it heats up.

Send the command M303 to autotune your PID. For more detailed instructions, check out Thomas Sanladerer's video guide for more information.

Not all firmware supports PID autotuning, and you may need to tune manually.

We recommend running two PID tunes for the V6, one now and one later at at normal printing temperatures, with filament in the hotend, sock attached, and with an active cooling fan on if you're planning on using one. This way your printer can finely tune its settings to match your real printing environment.

Typically you will use M303 E0 S210 C8. It will take a few minutes to run through the 8 cycles (C8) - it should then show a Kp Ki and Kd value. Write these down/ remember them for the next step.

Follow this with M301 P17.28 I0.63 D118.87 (These values will be different for you)

Then you can type M500 to store these value to your EEPROM, Optionally you can enter these values into your firmware manually.

For this example we have used Pronterface on a printer running Repetier firmware.

Step 32 PID Duet wifi/ethernet

For the Duet Wifi/ Ethernet running RepRap firmware the PID setup is slightly different:

M303 H1 P0.5 S240

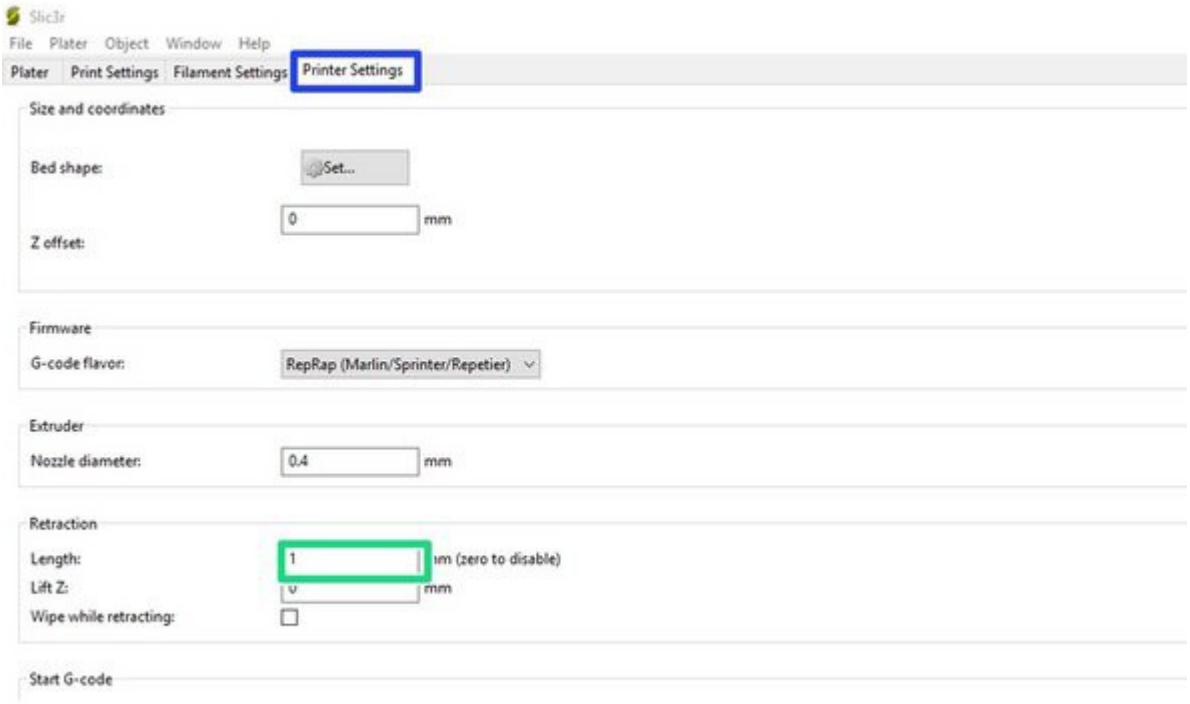
M307 H1 - display the result.

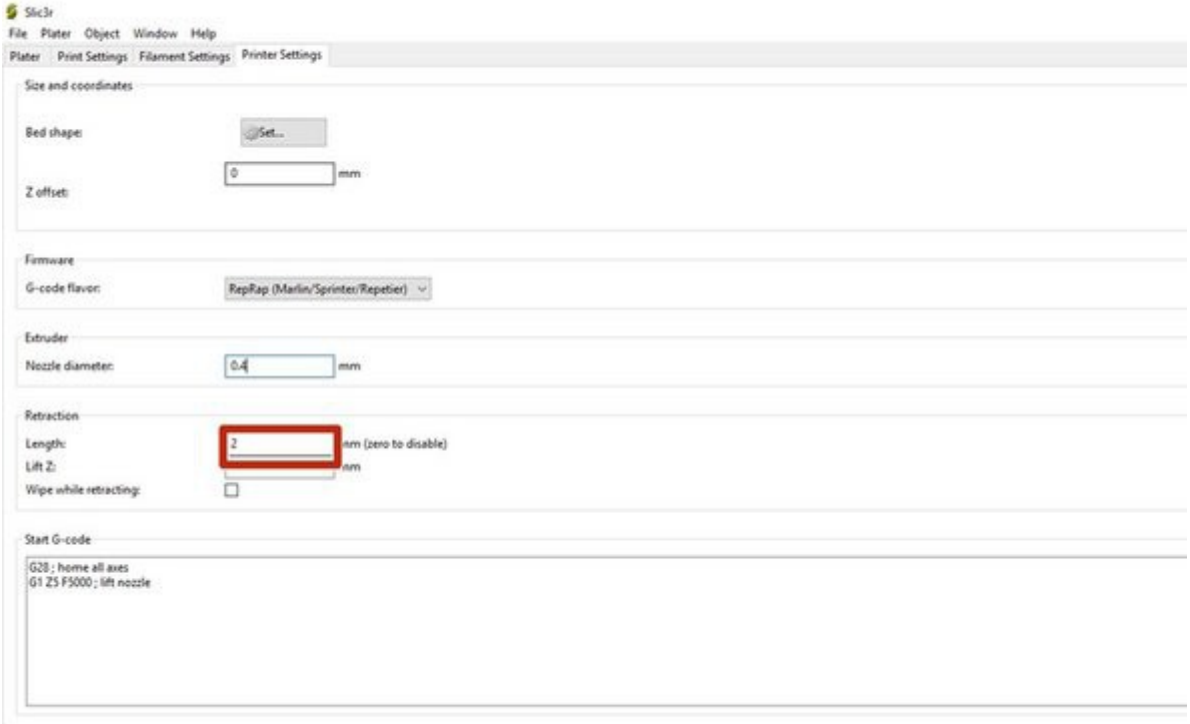
This should give you something that looks like this:

M307 H1 A352.6 C122.2 D8.0 S1 B0 - put these value into config.g

For more information please visit : https://betrue3d.dk/duet-wifi-configurat...

Step 33 Slicer Retraction





In your slicer of preference find the retraction settings. In Slic3r this is in printer settings.

Start with a retraction length of 1mm

If you experience blobs or stringing on the surface of the print increase the retraction length to 2mm.

Do not increase the retraction length more than 2mm as this can lead to molten plastic being pulled into the heat break, increasing the likelihood of jams.

Step 34 CONGRATULATIONS

You're now ready to go! Remember you'll have to update your slicer settings a little:

Check your nozzle diameter in your slicer. All V6 kits ship with a 0.40mm brass nozzle.

Having very long retraction settings will cause problems.

- For direct extrusion systems you should use anywhere from 0.5mm–2mm of retraction.
- For bowden systems you need to use the same as with direct + the compression strain, which will depend on the length of your Bowden tube.

Print PLAs at 205–215°C, and ABS at ~240°C. For other materials check with their manufacturer.

Comments:

But what if it would need more than 2 or even 3mm for bowden tube setup? How far i could go?

These instructions are very thorough except for one point which applies only to the Lulzbot TAZ5 or higher.

The connectors which come (came with my) with the E3D V6 kit are a modular plastic plug system. The TAZ (pick a number) hot end connection "harness" uses a "singular Molex pin termination" system. No one told E3D or MatterHackers for that "Matter."

If you own a TAZ and E3D continues to sell the modular plug system, you will need to clip off the plugs and crimpi Molex pins to at least the fan wires. Ask MatterHackers or Lulzbot if they sell thermistors and heaters with the Molex pins on the power wires. E3D support has informed me that they do not sell parts with the Molex pins. You may have to purchase these parts elsewhere. (Sorry E3D)

According to my information, neither MatterHackers nor E3D have the correct connections for the V6 hot end to Lulzbot TAZ.

The V6 "rocks!" but I am still waiting for parts.

> *Unless you purchase a Prusa specific HotEnd then the cables will come with our standard connectors, we do not sell printer specific kits at this point in item, it is down to the user to modify their wires for their specific setups if required.*

Additional notes from Creative Graphics Group

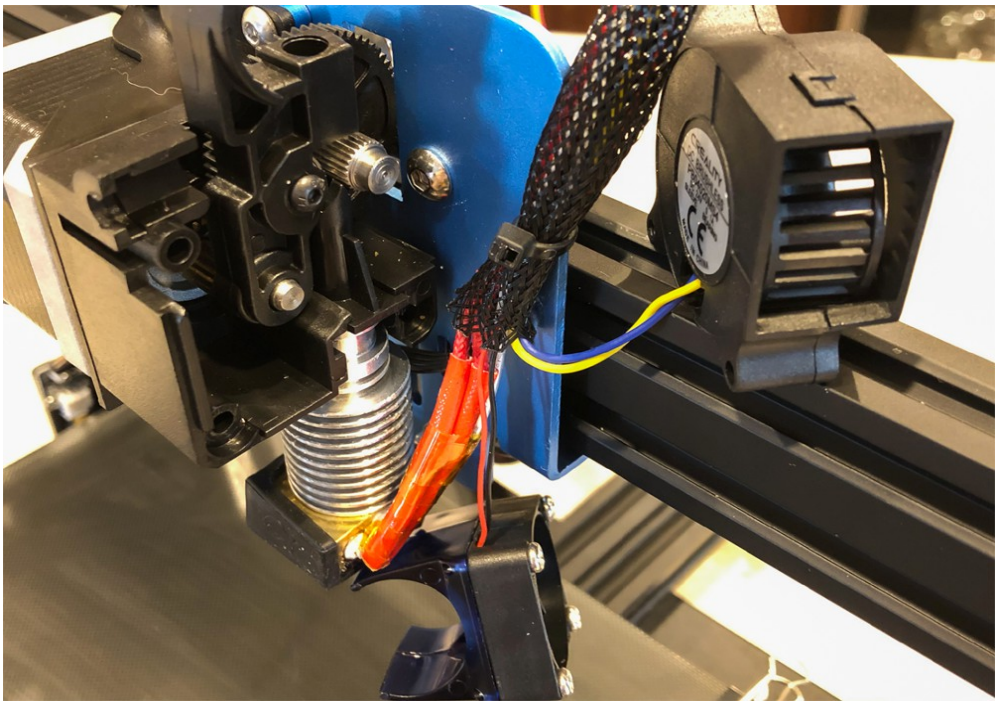
These are notes made specifically relating to fitting the V6 to a Sovol SV01.

The actual notes are at http://creativegraphicsgroup.com/e3d-how-to, this is just a summary.

Why did I want it?

To start, it's very popular due to it's performance. This means you'll be able to find support for the E3D V6 almost everywhere you go online. Since it is fully integrated into the E3D ecosystem, you'll have a wide range of nozzle to choose from - including the hardened steel "Nozzle X". You'll be able to choose from small nozzles for finer printing, to larger ones for faster, larger objects. It's also a "drop in" compatible hot end for the Sovol SV-01, making the conversion easier. Since it's an all metal hot end, you'll be able to print with nearly any 3D filament type: PLA, TPU, ABS, Nylon, Wood, Metal, etc. I had a few tough clogs on my stock hot end and wanted to upgrade away from that trouble.

Getting Started



Remove the 2 fans: One is the hot end fan that is screwed into the blue "round clip". You can pull the clip off of the heatsink. Remove the duct from the part cooling fan, then remove 3 screws found on the right side of that fan.

Removing the hot end

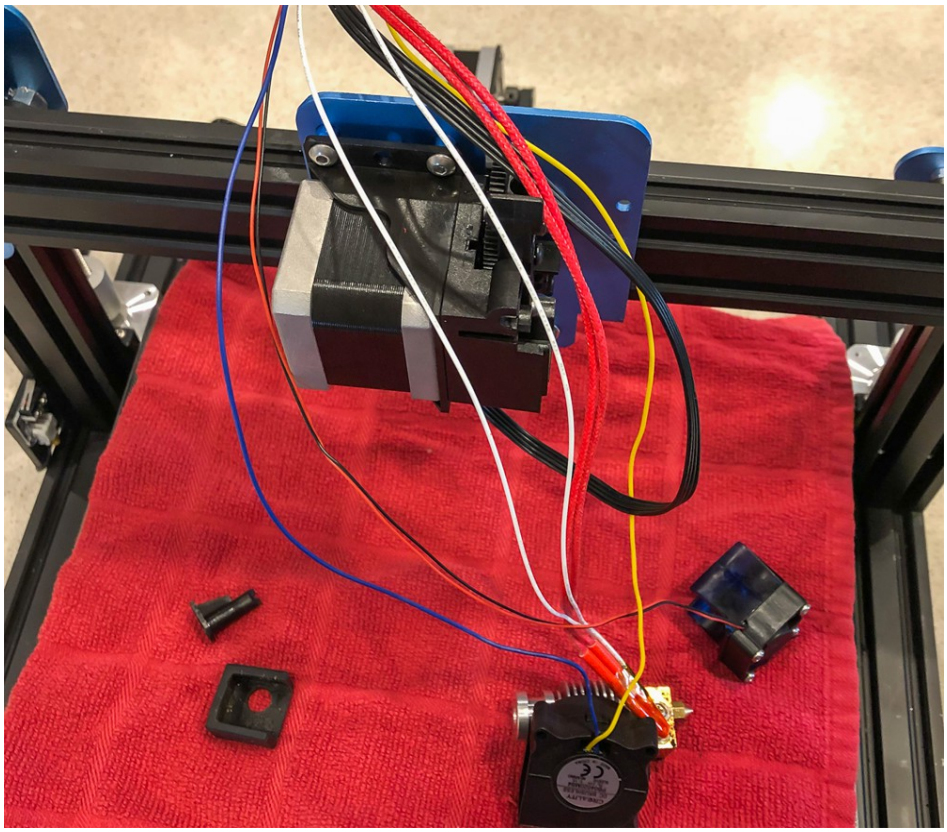
It kind of goes without saying, but you'll need to remove any filament that's left in the current hot end. You'll need to do this so you can have the top of the direct drive be clear.

You'll see the top of the cylindrical heatsink is held in place by friction. There are slots that the top portion fit into tightly. Above that, is a cone-shaped black piece of plastic that only fits in one way. That's a guide that gets your filament from the geared direct drive into the top of the heatsink, and down to the heater block. As you pull the heatsink out, the guide will come with it. Pay close

attention to how it sits in, for when you have to put it back together. I used one hand to place it against the bottom of the drive assembly, and pushed the heatsink out with my fingers. When looking at the bottom of the nozzle and heater block, you can see why I wanted to replace it! One too many leaks/clogs...

Wires

After the assembly has been removed, you can remove the small cable tie that holds the shield and wires to the blue back plate. This will give you more room to work with.



Tidy up

With the wires all loose, I found it best to push back the mesh way above the direct drive (out of the way) and secure it there by placing a temporary zip tie. This way, it holds the mesh back, so it didn't keep pushing everything towards what I was working on.

Disconnect heater block & heatsink

With a wrench, hold the brass heater block, and carefully unscrew the aluminum heatsink.

Remove nozzle

Using a metric size 6 socket, carefully remove the nozzle from the heater block. Note that mine was pretty well clogged, and I was replacing with a better Nozzle X, so I wasn't too worried about what happened to mine. However, you'll probably want to reuse this if not upgrading your nozzle. If it's jammed with clogged filament, you can try safely heating the nozzle beyond the filament's melting point and using pliers to pour out the melted plastic, then cleaning. Again, be very safe with this very hot metal and plastic if you choose to do this!

Building the new assembly

Next, we'll start building the new assembly. Start by placing your nozzle (in this case, the hardened steel Nozzle X 0.40mm). You'll want to tighten it all of the way, then turn it counter-clockwise one quarter turn. This is allows for a little space to tighten after screwing in the heat break.

Screw in the heat break from the opposite side of the nozzle - small threaded end goes in. Screw this in until it touches the nozzle, then tighten the nozzle against the heat break. Don't over-tighten, as we'll be hot-tightening later.

Before you slide the Thermistor into place, you can start the small M3 grub screw so that it's flush with the inside hole:

NOTE on electrical connections: You have a choice to make for the type of connection to the new thermistor and heater cartridge: either place new connectors, or solder. Soldering: If you choose to go the route I did, you will need to cut the old thermistor and heater cartridge off of your machine, and solder + heat shrink the new set to the existing wires. We will not be covering this, because you could have an entire tutorial on soldering properly. Connectors: They are not included in the kit, so you'd

have to purchase separately.

Also, you'll need to ensure you have the proper heater cartridge in the kit, as the SV-01 is 24v (but they also sell a 12v). See the E3D documentation on how to verify you have the proper heater cartridge.

Thermistor

Slide in the thermistor cartridge so that it's flush where the wires come out. Screw in the grub screw in the rest of the way, until it just touches the thermistor. Tighten it by about 1/8 of a turn. Don't over-tighten, as it is soft and can get deformed. You don't want to damage the Thermistor, as it's what helps prevent over-heating!

Be careful of what you read, or which YouTube videos you watch. I watched an older video that showed placing the heater tightening screw on the wrong side of the heater block as shown in the grey image below. It will not work to tighten the block around the heater. DON'T DO THIS!

If you do...

If you do this like I did, you'll totally strip that screw, and it'll be hard to get it out. In fact, I had to take a hack saw and cut a slot for a slotted screw driver, in order to get it removed. Thank goodness E3D gives you 1 extra of this screw...

Install the heater cartridge (properly)

Place the heater cartridge in its opening. Note the orientation below. Also note that each end of the cartridge does stick out of the hole a bit, intentionally. Now, place the screw in the proper, smaller side of the heater block clamp area and tighten enough so that your heater cartridge can't come loose. Do a little test by tugging slightly on the wires to make sure it won't come free.

Installing the PTFE tube

One of the great benefits to this upgrade is that you will have a full PTFE tube from the heater block all the way up to the direct drive. This is useful so that there's no place for melted plastic to gather and clog. We'll install and measure it now...

Trim the bottom end

You'll need to make sure that the end of the PTFE tubing that will sit inside your hot end is square and flat. You might want to place some filament in the tubing before you cut it, to ensure it stays round and doesn't flatten. Cut a small slice off with a very sharp knife like a craft knife, Xacto blade, etc.

Measuring the PTFE tube

Insert the Collet Clip into the top of the Heatsink. This prevents the PTFE tube from moving, as it grabs it a bit. Install the PTFE tubing until it reaches the bottom. Make sure it's all the way down:

Next, put the cone-shaped filament feeder piece in place, next to the tubing, but on top of the Collet Clip. (The tubing is too long to fit inside the cone.) We'll need to measure how high the PTFE tube can go, and mark it at the bottom of the "wedge" shape. The goal is to get the flat top of the tube to rest against the bottom of the wedge on the cone. Nope, Sharpie markers aren't great for a slippery PTFE tube...

Cutting the PTFE Tube

Again, you will likely want to put some filament in the top end that you'll need to cut, to ensure it doesn't flatten as you slice through. With that sharp blade, carefully cut the PTFE to match your marking from the step above.

Fan

Another thing that happened to me, is that the original factory fan that came with my SV-01 broke the tiny plastic connection between the blades and the casing. So I needed a new heater block fan. Luckily, it came with the kit.

If you are re-using your original fan and duct, simply attach it to the heatsink. If you're re-using, you'll have to solder (or use a connector) the new fan to the system, and then screw it into the fan duct.

Either way, make sure the fan covers the fin closest to the heater block, and blows towards the heatsink.

Firmware update needed

Before we can continue, you must have new firmware added to the printer, in order to have it understand the values coming from the new thermistor. I'll cover rebuilding the updated Marlin firmware in an upcoming tutorial.

You will need 2 builds to install this properly: 1) "temporary" build that allows you to set the max temperature artificially high for our next step, and 2) the one that you will continue to use every day. If you cannot build this yourself, reach out for help here, or on the SOVOL 3D Facebook group. Chances are that someone has built what you need before.

Please understand that you have to make sure you match to exactly what you have in your system. For instance, BL Touch / No BL Touch, E3D V6 thermistor or stock, silent board or not, etc.

If you're building the firmware for yourself or finding one built online for the E3D V6, ensure that it has set the line in config.h to "#define TEMP_SENSOR_0 5". This tells it that it's the type of thermistor that E3D uses for the V6. If your system doesn't know the type of thermistor, you aren't going to be measuring the heat properly, which is very dangerous.

For the max temperature setting, here's where it gets tricky: you'll have to set this value artificially high, as the LCD UI lowers the actual max temp by 15 degrees under what's set as maximum (for safety). While the metal of your new E3D V6 hot end can withstand very high temperatures, your thermistor can only go up to around 285°C for extended periods. To get the hot tightening done in the next step, you have to bring it up to the max temp of 285 - this means that we'll need to set it temporarily to 300°C (285 + 15 = 300). MAKE SURE THAT YOU DO NOT LEAVE IT AT 300. To set this value (if you're rebuilding), find the line that reads "#define HEATER_0_MAXTEMP" and change the current value to 300. Rebuild it and flash the printer with this update.

Hot Tightening

Now that we can get the printer to 285°C, we will perform the last mechanical step before reassembly. This is very important in order to seal the nozzle and heat break together to ensure that molten plastic cannot leak out of the hot end in use. That's a nasty problem that you don't want to have to diagnose later...

- Using the SV-01 LCD, set the nozzle temperature to 285, wait for it to reach that temperature, and wait 1 additional minute for it to equalize.
- Gently tighten the nozzle while holding the heater block still with a wrench. You'll need a 7mm socket to tighten the nozzle. This will tighten the nozzle against the heat break and ensure that your hot end does not leak.

- Aim for 3Nm of torque on the hot nozzle - about as much pressure as you can apply with one finger on a small socket wrench.
- When it's tightened, go back to the SV-01 LCD and reduce temperature all of the way to cool it back down.

Note: Don't apply the wrench or pliers to the heater block until it has come up to temperature. (I rested mine on the glass bed until then.) The reason for this is that the heat will transfer from the heater block to the metal wrench, and never get up to the proper temperature. This will likely cause a "timeout" error. Make sure that you don't burn yourself when getting the wrench on that very hot metal! (I used another pair of pliers to hold it, then got the wrench on the block and tightened it.)

Wrapping up

Once you have done the hot tightening step above, you'll want to take the "standard" version of the firmware, and flash that back to the SV-01. Follow the same steps as mentioned above (we like using CURA to send it to the printer), but make sure you are not using the 300 degrees version but rather the standard temperature version. This is for your own safety.

A word on firmware versions

We tend to use the CopterTEC releases. I'm still running 2.0.1 because I haven't needed to use anything newer than that. However, we know that they continue to update based on the new CURA features. Also, the SOVOL engineers release great, stable builds. I chose 2.0.1, because in December/January when I upgraded my hot end, the SOVOL engineers were still working through their quality process. That can't be understated - they take time because they need to, and you should appreciate that. The SOVOL team is great.

Re-assembly

By now, you should be really familiar with how the printer came apart. It's literally a matter of going backwards, to re-assemble the parts. However, here are a couple of areas that we've found tricky:

- With the new PTFE tube being longer, getting the assembly in place is tricky. We suggest that you place the cone partially in place (using the slots as a guide) at the top, and then getting the heat sink to push into place. Yes, it will be a bit tight, but it will fit.
- Use Kapton heat tape (Amazon link) just outside of the heater block, like how it came when you got it. Don't use a ton.
- Orientation of the heater block and wires: We found that the wires are best to go out towards the back of the printer. It makes it easier to zip tie back up, and get everything to align with the wire wrap. It will make it a bit tricky to get the E3D blue silicon sock to go around the heater, but if you take your time, it will fit.

Neaten it up a bit

With that said, make sure to zip tie the wires so that they are nice and neat. Don't forget there's a hole on the aluminum behind the carriage where you can zip tie the wires in place. (You have previously cut the existing wire tie to make room to work on everything.) Let loose the zip tie that was temporarily holding the wire wrap, bring it back down in place, and re-zip tie it so that it's neat

again and covers all of your assembly. I had a bit of extra wire from my thermistor and heater cartridge, so I had to tuck it into the wire wrap a bit. Don't worry - it can take it, and should look

Nozzle height

After you get it all back together, you may notice that the bottom of this nozzle sits almost 1mm higher than the stock nozzle. (Meaning, that it's "shorter", from the point of view of the heater block.) The issue you may run into is that the bottom of the stock fan duct will be lower than the nozzle, and will likely hit your prints.

You could try to find a more shallow fan duct, but given the fact that the stock duct is pretty thick and the bottom of it comes very rough in the first place, we simply sanded some off of the bottom with a palm sander until it cleared properly. That plastic is pretty hard, so it will take a bit. People often find it handy to use some electrical tape to make sure it doesn't slip out of the fan housing in the middle of a print.

Get printing!

It was a bit of work to replace the E3D V6 hot end. But it's also such a relief that I don't have clogging issues. I can't stress enough how much I also appreciate the choice of the hardened steel NozzleX nozzles. So far, I have a 0.4mm and 0.6mm nozzle, and they just don't wear like brass nozzles (no change in the opening diameter, so far!) and consistently produce great prints. The combination of those two have the SV-01 printing like a much more expensive printer, and it's now super reliable. Let us know what you're printing by visiting the Creative Graphics Group Facebook page!

Additional notes from actual install

This is in addition to assembly notes from E3D and fitting notes Creative Graphics Group (http://creativegraphicsgroup.com/e3d-how-to). This was to fit a V6 with 0.4mm Nozzle X, but would equally apply to other nozzles.

Purpose of fitting this was to allow future use with Nylon / PETG with carbon fibre.

Disassembly

In order, need to remove:

- Part cooling duct and fan.
- Metal cage around whole hotend assembly.
- Extruder cover.
- Filament pressure adjusting screw and spring (not strictly necessary but avoids it pinging off unexpectedly).
- Manual level with pressure roller (also not strictly necessary).

When disassembling, note:

- Note that the screw bottom right holding the part cooling fan (and duct) is longer than the other two.
- When removing the extruder cover, take out the adjusting screw and spring carefully – tends to ping off (best to remove for safety). Bottom right cover screw is shorter.
- When sliding out the hotend with black feeder cone on top (quite tight), note that the cone has an elongated base on one side, and that side faces outwards.

Hotend size

The complete new hotend from top of heatsink to bottom of nozzle is ~1.5mm shorter than the Sovol one, and also the heatsink diameter is slightly bigger. This means:

- The part cooling duct needs replacing or modifying to make it less deep so it won't hit the print.
- The old hotend fan clip cannot be used.
- The bolt holding the bottom right carriage eccentric nut and X roller is slightly too long – hits the heatsink. Either cut / grind about 1mm from it, or put one or two washers at the head end so it doesn't protrude through quite so much.

Wiring loom connections

If one wishes to make the heater easily changeable, put a connector in the heater cable. Use as a model the E3D upgrade replacement – use a Molex Microfit 3.0 two pin, cut the cable 105mm from the cartridge to make it the same length, same plug/socket orientation – then a replacement would drop straight in.

For the same ease of replacement reasons, can put a breakout connector in the hotend fan cable. Used a JST RCY connector (two pin) – slimmer. Plus on pin 2, pins on the fan end.

(No need to change any of the cables right back to the mainboard, just cut into the Sovol ones and fit Molex / JST connectors as above. Also fitted the requisite connectors above to the old hotend and fan so if necessary it could just be dropped straight back in).

Heater voltage and power

The new heater (30W, 24V) measures ~19R. The old Sovol one was ~13R. Therefore the old one was actually 40W.

This probably explains why the CopterTec (Marlin 2.0.5.3) V1.6.3 build had the P and I gains too high – it was expecting 30W. Need to set P/I/D extruder heater gains.

Nozzle, heaterblock, heat break, heatsink assembly

The E3D notes were inconsistent about how far to back off the nozzle from the heater block for hot tightening (said 1/4 turn in one place, full turn in another). Compromised on 1/2 turn. From the design, the important characteristics appear to be:

- When hot tightening, it is important the nozzle tightens against heat break, not the heater block (for sealing).
- Also important that maximum nozzle thread is used in the heater block, partly for heat transfer, partly for strength on tightening.
- When the heatsink is screwed down on to the heat break, it must NOT touch the heater block, and no heatsink compound must bridge the gap – need minimal heat transfer up to the heatsink.

With the nozzle backed off 1/2 turn on assembly, all the above seem to be met, and after hot tightening (see later) the nozzle to heater block gap was ~0.5mm.

PTFE tube

When fitting the PTFE tube:

- Do NOT use either the black collet or blue locking clip, the feeder cone sits right on top of the heatsink.
- Make sure the scalpel blade is new and very sharp, and ideally use a jig.
- Make sure the tube goes right down into the heat break top relief.
- Cut it so when the feeder cone is fitted, the cone sits slightly proud (maybe 0.25 to 0.5mm) of the heatsink, so slight downward pressure will make it flush. (The tube measured as ~49.4mm when cut).

Heater block orientation

The heater block was orientated with the narrow dimension to the front of the printer, cables coming out to the right, ie heater at the front, thermistor at the back. This was done so the short cable on the thermistor (back right) had the least distance to go out to the loom. Not sure this was best (see below).

The hotend fan shroud has an overhang which can go up or down. Put it down so it didn't touch the motor / extruder. Note that if down, and the block is orientated as above. it is very hard (impossible, really) to get the heatsink sock fully on at the heater end when it is in place. Would be better with the overhang up if it didn't hit the motor / extruder.

Reassembly

When the hotend /feeder cone are slid into the extruder, they are a looser fit than the Sovol hot end, but not actually sloppy, so presumably OK.

Firmware

Firmware used was CopterTec (Marlin 2.0.5.3) V1.6.3, modified for thermistor and max temperature.

Hot tightening

When hot tightening, used 2.1Nm, not 3Nm, as some people seem to have stripped heater block threads at 3Nm. Doesn't seem to be leaking.

Wiring loom

The wires were a bit of a tight fit. They were fed out to the loom as follows:

- Extruder stepper cable and thermistor cable out of the small cutout in the metal enclosure just below the mounting screw on the right. (Thermistor cable before connector was so short that was the only place it would go).
- Heater and hotend fan out the the top cutout above the right hand enclosure mounting screw.
- No Kapton tape used.
- Fixed to the blue bracket with a cable tie.

Part cooling duct

As above, the duct needs shaving down. Took the duct from Thingiverse (https://www.thingiverse.com/thing:3984064) and removed about 0.7mm from the base (first three layers at 0.2mm layer height) with Meshmixer, then trimmed the bottom corners. Still a bit tight, needs a redesign.

Adjustments

PID autotuning via Pronterface produced P=27.7, I=2.77, D=79.7 at 220C. Seems to work OK.

Z offset was set again, and is now -1.55mm vs -0.25mm previously with Sovol hotend.

A temperature / retraction tower indicates eSun PLA+ is best for stringing at 220C / 0.8mm / 40mm/s. Previously was 205C / 0.8mm / 40mm/s, difference is probably poorer heat conduction to nozzle (steel not brass), but may also be partly down to tolerance in thermistors (different type, anyway).

Printing performance

Only tested with PLA+ at this time, but seems fine. Possibly marginally less stringing on the tower, but difficult to tell. If so probably caused by less 'give' in the internal hot end metal components (less PTFE, more metal).

Warm up is slower with the 30W heater, but also overshoots less. Temperature stability very good.

Only really noticeable difference so far is that for some reason it dribbles a lot less on initial warm up. Main tests will come with PETG / Nylon / CF.