

E3D-v6 Assembly

From E3D-Online

Assembly of the E3D-v6 HotEnd should be an easy process that takes no more than half an hour. Please follow the instructions on this page carefully to ensure that you assemble the HotEnd correctly.

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What's in the box

Metal Parts

- 1 x Aluminium Heatsink (Contains embedded fitting for tubing in 1.75mm Universal and 3mm Bowden versions)
- 1 x Stainless Steel Heatbreak
- 1 x Aluminium Heater Block
- 1 x Brass Nozzle (0.4mm)

Electronics

- 1 x 100K Semitec 104GT2 NTC thermistor with 100mm x Silicone Fibreglass Sleeving
- 1 x 12v or 24v 25W Heater Cartridge
- 1 x 12v or 24v 30x30x10mm fan
- 1 x High Temperature Fiberglass Wire - for Thermistor (150mm) OR 1m of Thermistor wire (with 0.1" connector when available)
- 4 x 0.75mm Ferrules - for Solder-Free Wire Joins

Fixings

- 4 x Plastfast30 3.0 x 16 screws to attach the fan to the fan duct
- 1 x M3x3 socket dome screw and M3 washer to clamp thermistor
- 1 x M3x10 socket dome screw to clamp the heater block around the heater cartridge
- 1 x Fan Duct (Injection Moulded PC)

Bowden Versions also Include

- 800mm of appropriately sized PTFE tubing.
- 1 x Screw in Coupler for extruder end of tubing.

What you need

- 16mm Spanner
- 7mm Spanner
- Pozi-Drive Screwdriver
- M2.5 Hex Wrench - we supply these in the kit when possible

Warnings - Please Read!

1. The HeatBreak is fragile. If you are using a large spanner, hitting it with a hammer, etc. It will break.
2. The thermistor is small and fragile. Be gentle with the legs. The bead is made of glass - don't crush! It is also very small, so don't breathe.
3. You are dealing with high temperatures - the HotEnd gets hot, and may be off your printer when you do the initial tightening. If you touch it, you will get burned!
4. You are dealing with high currents, make sure you double check all your wiring and your power supply rating. It is not recommended to work on anything whilst it is plugged in. Bad wiring with improper current ratings can cause fire.
5. Be sure you have ordered (and received!) the correct voltage heater and fan to match your 3D printer. If the heater cartridge specification is not lasered onto the cartridge, you can easily check with a multimeter, this is described in the #Heater_Cartridge section. Connecting 12v parts to 24v power can result in overheating, component damage or fire.
6. The E3D-v6 is a high performance HotEnd, capable of reaching a wide range of temperatures. The temperatures that ignite some plastics are within the normal printing temperatures of other plastics. If you only plan on printing ABS, PLA, and/or Nylon, it is recommended that you set your heater cartridge "MAX_PWM" to 150 in your firmware, in order to limit the E3D's heater to a range suitable for these plastics. If you are not printing materials requiring ~300C, there is no need for "MAX_PWM" to be set over 150. This variable can usually be found in the configuration.h file of your printers firmware. You can always change it to a higher value when you want to experiment with higher temperatures, it is much more difficult to extinguish a housefire.
7. Like all 3D printers, printers fitted with a high temperature all metal hotend can be a fire hazard. You are using experimental technology to heat and melt plastic, in a machine that you may have built or modified yourself, that likely does not have safety certification or significant failsafes. Fire/Smoke alarms, supervision of your printer while printing, and expertise should not be considered optional.
8. Your HotEnd and your printer is your responsibility. We cannot be held responsible for damages caused by the use, misuse or abuse of our products.

Assembly Steps

HotSide



Nozzle screwed into block, and unscrewed a 1/2 turn.

Screw Nozzle into the Heater Block into the end closest to the thermistor holes.
Unscrew the Nozzle a 1/4 to a 1/2 turn.

Screw the Heat Break into the other side of the Heater Block so it is butts up against the nozzle.



Break screwed into block level with top of block.



A first, slight tightening of the nozzle against the break.

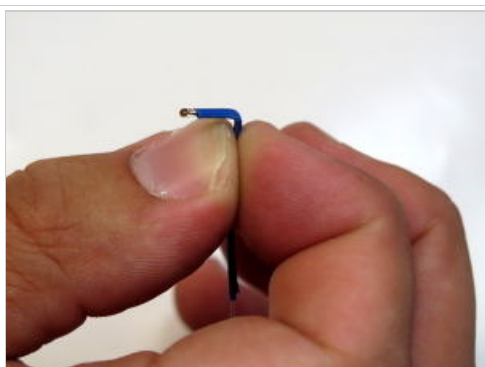
Gripping the Heater Block with a spanner, tighten the Nozzle with a second spanner. **Do not over-tighten, we are going to tighten it up later when the heater block is hot.**

Thermistor



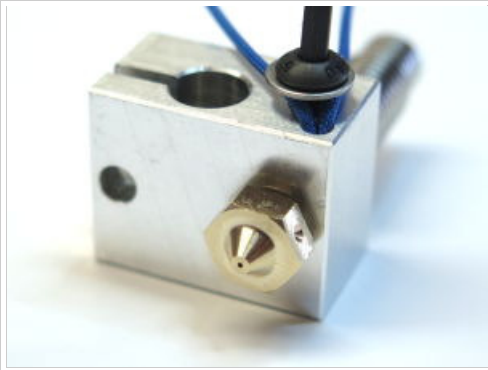
Cutting the sleeving to length. Sleeving on thermistor.

Cut the blue glass-fiber sleeving into 2 x 35mm lengths and slide them onto the legs of the thermistor. Optional: Crimp a ferrule on each leg over the sleeving (as shown in the photograph below) to ensure the sleeving stays in place. Ensure you position this ferrule such that it will not touch the heater block when assembled (you will need to place it some way from the thermistor head if you are assembling a volcano heater block).



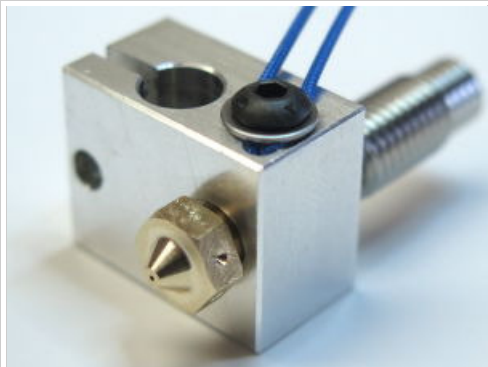
Thermistor bent into initial shape.

Holding the thermistor between your finger and thumb, make a 90° bend in the legs about 5mm from the tip of the bead. Thermistor bent into initial shape.



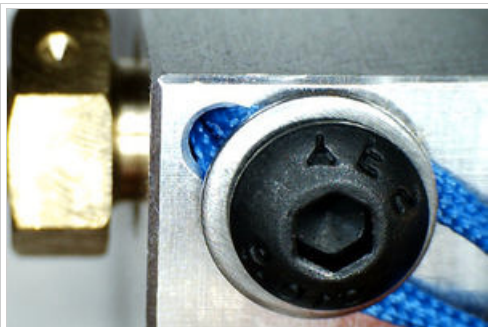
Thermistor being clamped into place.

Place the of the thermistor into the hole, and fasten in place using the smaller M3x4 screw and washer. Use your fingernails to keep the sleeving under the washer whilst tightening.



Thermistor clamped into place.

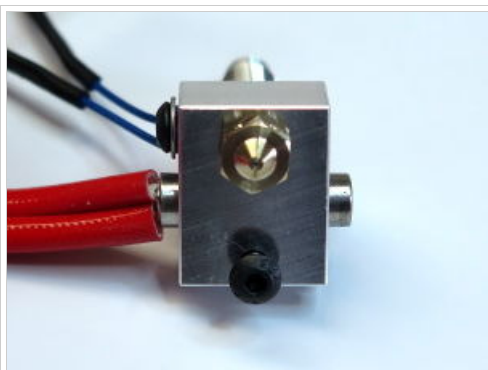
It should look like this when clamped.



The sleeving runs into the thermistor hole insulating it right down to the glass bead.

Visually check that the blue sleeving is insulating the legs of the thermistor right down to the bead. If the legs make electrical contact with the block or eachother your temperature readings will be incorrect and you risk overheating.

Heater Cartridge



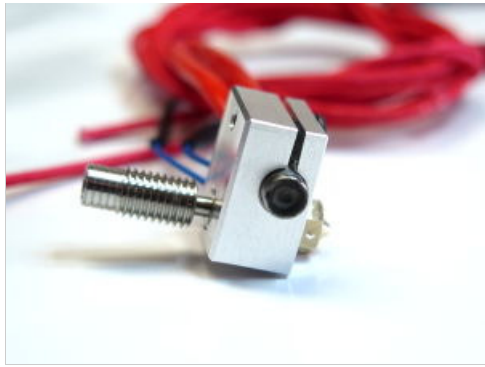
Heater inserted into block.

If you have one, grab a multimeter and check the resistance of your heater cartridge against the table below. Expect your value to deviate a little from these, however if yours is significantly off or you are concerned you have the wrong cartridge please get in touch.

P\V	12v	24v
40w (Red Leads)	3.6 Ω	14.4 Ω
25w (Blue Leads)	5.76 Ω	23.04 Ω

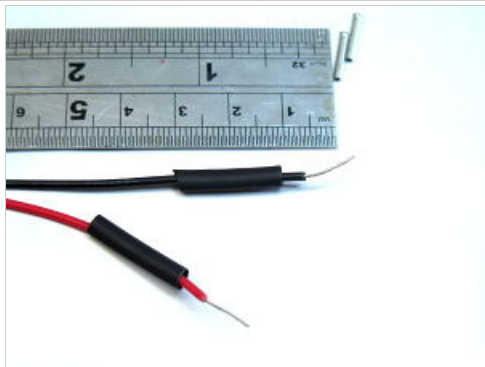
Insert the Heater Cartridge with the leads exiting the block the same side as the thermistor. Centre the cartridge in it's hole in the block.

Tighten the clamping portion of the heater block around the heater cartridge with the longer M3x10 screw. As in the photo below you should be able to see very slight deformation of the heater block clamp as it wraps around the cartridge for maximum thermal contact.



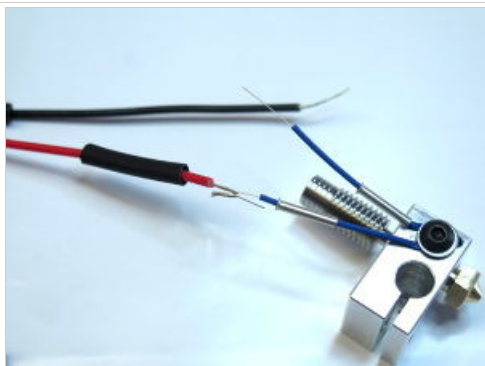
HeaterBlock tightened around cartridge.

Thermistor Wire



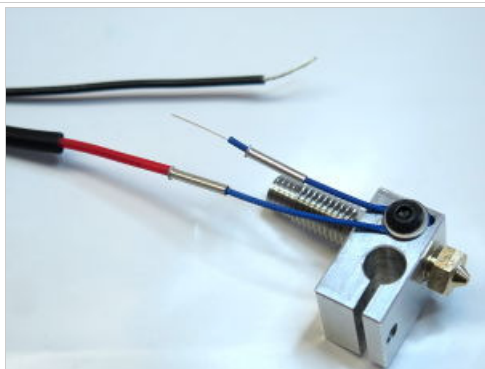
Stripped wire with heatshrink.

Strip the ends of the red and black thermistor cable and put a length of heatshrink over each wire.



Thermistor wires formed into hooks ready to crimp.

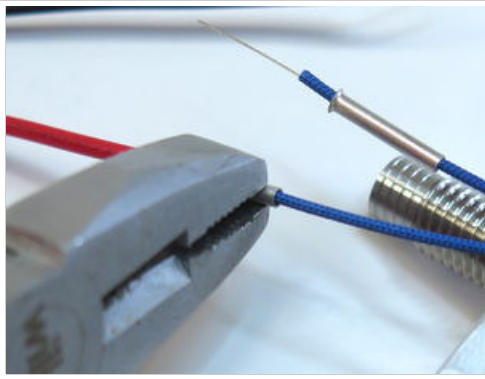
Place a ferrule on each sleeved thermistor leg, if you have the flared mouth of the ferrule pointing away from the hotend it makes it easier to push them over the wires later. Form the thermistor wire and bare portion of the thermistor legs into hooks, and hook the legs together.



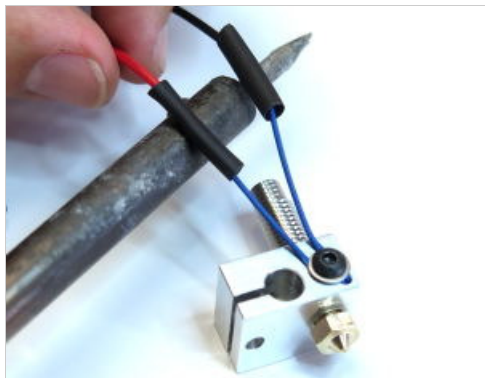
Ferrule over bare portion of wires.

Push the ferrule over the bare portions of the wires ready to crimp into place.

Crimp the ferrules by firmly crushing them with a pair of pliers. You can use a fancy ferrule crimping tool if you have one, but it's not needed.



Crushing the ferrule.



Heatshrink being shrunk.

Slide the heatshrink down over the now crushed ferrules and shrink into place with a heat source such as a soldering iron, hot air gun or even a flame.



Heatsink is screwed down onto top of heatbreak.

Screw the HeatSink onto the HeatBreak by gripping the heatsink in one hand and the heater block in the other. It only needs to be tightened up hand-tight. Do not overtighten.

PTFE Tubing (Where Applicable)

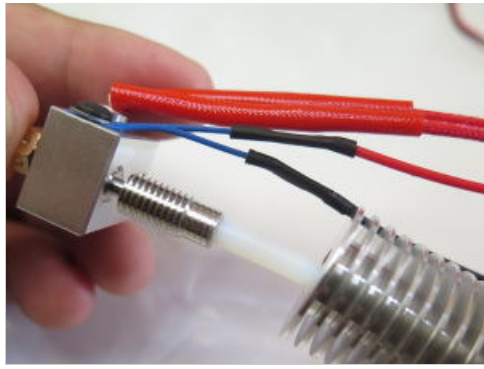
1.75mm Universal (with Bowden)



PTFE Tubing being pushed down into HotEnd.

Insert PTFE Tubing

- These steps apply only to 1.75mm Direct, 1.75mm Bowden, and 3mm Bowden users. 3mm Direct does not use any PTFE tubing.
- The PTFE tubing in the 1.75mm Direct configuration is not optional, you must use the tubing or the HotEnd will not function properly.
- The tubing should be inserted from the top of the now assembled hotend and pushed as far down into the hotend as possible.
- In the 1.75mm versions the PTFE tube actually runs through the Heat Sink and into the Heat Break, please ensure the tubing is seated as deep into the hotend as possible.



PTFE going down into Heat Break.

In 1.75mm HotEnds the tubing passes right through the heatsink and into the heatbreak. Below is an illustration of how far down the PTFE tubing must extend. The photo below is not an assembly step, just an illustration of what should be happening inside your hotend.

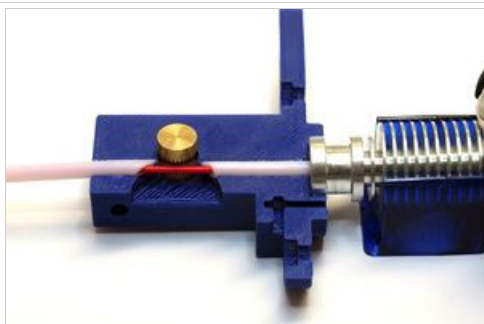
3mm Bowden



3mm PTFE Tubing Inserted.

In the 3mm Bowden version the PTFE tubing pushes into the top of the heatsink and stops inside the heatsink.

PTFE Recommendations

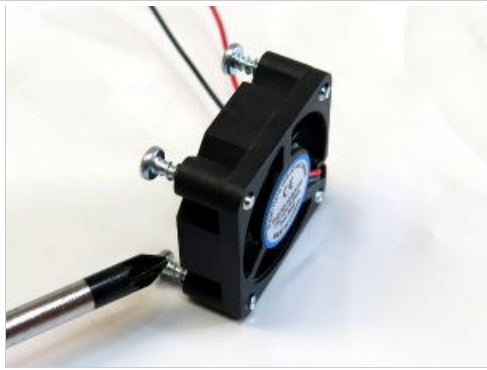


An optimal tubing configuration in a wades extruder.

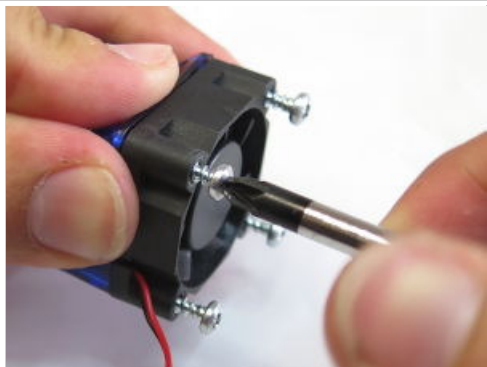
- To release the tubing from the heatsink simply press down on the black or grey collet in the top of heatsink while pulling on the tubing.
- In 1.75mm Direct configurations thought should be given to running the PTFE right up as close to the hobbed bolt/driver gear as possible as this provides the easiest loading and the best performance with all filament types. However if you do not wish to run PTFE up to the hobbed bolt or driver gear you can simply cut the tubing off flush with the top of the hotend.
- Shown below is a cutaway illustration of how an optimal PTFE configuration might look in a wades type extruder. The PTFE tubing extends right up to the hobbed bolt.

Fan & Duct

- Figure out which way up you want the fan-duct to sit on the HotEnd given your particular mounting arrangements. We recommend mounting it with the over-hang at the top. If you have it hanging down however, please keep it clear of the heater block.
- Remove the fan duct from the HeatSink.
- Screw the screws into the fan such that the ends are just protruding from the other side of the fan. The sticker of the fan must face the heatsink to blow air over the heatsink.



Fan with screws inserted.



Screwing fan to duct.

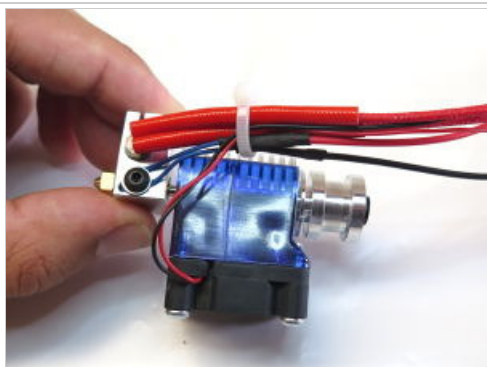
Using the 4 Plastfast screws, attach the fan to the fan-duct such that the wires exit the fan in a convenient location - preferably such that it can be bundled in with the thermistor and heater cartridge cables.

It can sometimes take quite a lot of torque to get the screws all the way in. Be sure to select a screwdriver that is a good fit or you risk stripping the heads of the screws.



Fan duct clipping to heatsink.

Clip the fan duct to the HeatSink.



Cable tie all wires together.

- Cable-tie all cables together as additional strain relief.
- It is important to ensure the wires of the fan and the red/black section of the thermistor cable are cable-tied and strain relieved in such a way that they cannot come into contact with the heater block at any time.
- Fan should be wired directly to a 12v power supply and be constantly running. Do not connect to a "Fan" output of a controller board or similar, these are for fans that cool the printed object, not a hotend fan which needs to always be running.

Configure Firmware (Easy!)

In the following stages we are going to configure the HotEnd in firmware then go on to do the final hot-tighten of the HotEnd. This can be done either on or off your printer, however where practical we recommend doing it off your printer, then mounting.

Connect the heater-cartridge and thermistor to your electronics board. If you have a non-12V system see this forum post. Please refer to the documentation specific to your electronics for Pin-Outs and other technical information which may be relevant to the HotEnd installation.

Marlin

Reconfigure your firmware for the Semitec 104GT2 thermistor: In configuration.h:

- `#define TEMP_SENSOR_0 5`

For safety it is strongly recommended to do the following:

- Limit the maximum power to the heater (*PID_MAX xxx* in configuration.h)
- Set the minimum temperature to detect bad wiring (*HEATER_0_MINTEMP 5* in configuration.h)

In newer versions of Marlin there are extra features for Thermal Runaway Protection (<https://github.com/MarlinFirmware/Marlin/blob/Development/Marlin/Configuration.h#L227>) should your thermistor come loose.

Upload the new firmware to your electronics.

Repetier

Use thermistor definition number 8:

- `#define EXT0_TEMPSSENSOR_TYPE 8`

Or select "ATC Semitec 104-GT2" if using the Online Configuration Tool (v091) (<http://www.repetier.com/firmware/v091/>)

For safety it is strongly recommended to do the following:

- Limit the *Max PWM value* (*EXT0_PID_MAX xxx* in the config file) to ensure that current is limited to a safe value.
- Set the *Minimum defect temperature* to ensure that the thermistor shorting out is caught by the firmware.

New in Online Configuration Tool (v092) (<http://www.repetier.com/firmware/v091/>) are the two options to also improve safety:

- *Decouple hold variance* and *Decouple min temp. rise* to detect the thermistor coming loose. These must be set appropriately for your system to ensure that they work properly.

Upload the new firmware to your electronics.

Smoothieware

Use thermistor definition "Semitec":

- `temperature_control.hotend.thermistor Semitec`

For safety it is strongly recommended configure your firmware to limit the maximum heater power:

- `temperature_control.hotend.max_pwm xxx`

Upload the new firmware to your electronics.

RepRapFirmware

Use the Beta value 4267K.

For safety it is strongly recommended configure your firmware to limit the maximum heater power:

- `define PID_MAX {-1, xxx}`

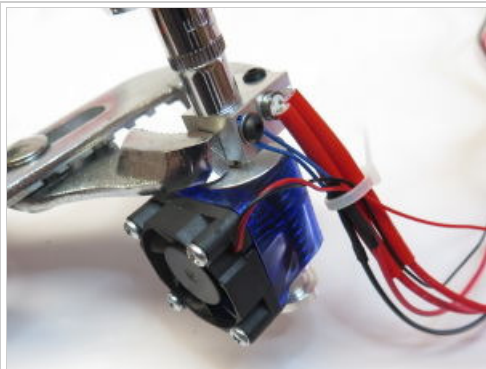
Upload the new firmware to your electronics.

PID Tuning

- Connect to the printer
- Run M303 to autotune your PID - check out Thomas Sanladerer's video guide for more information. Please note that not all firmwares support autotune, and you may need to tune manually.
- Set the HotEnd temperature to 285°C. If you did not do a PID tune, then approach this temperature slowly, exceeding 295°C will

permanently damage the thermistor.

Final Tightening



Doing the final tightening of the nozzle.

- When the HotEnd is at temperature, tighten the nozzle whilst holding the heater block with a spanner. 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. The nozzle does not need to be torqued down incredibly tightly to form a good seal, when at lower temperatures the aluminium will contract and hold the Nozzle and HeatBreak together.

You are now ready to mount the HotEnd to your printer. Happy Printing!

Usage Guidance

In general the E3D-v6 hotend is highly tolerant of most printing conditions and is designed to accept the vast majority of filaments on the market. There are however some things to be aware of:

- Filament must be within acceptable diameter tolerance. For 1.75mm this means 1.70mm - 1.80mm and for 3.00mm/2.85mm the filament must be between 2.80mm and 3.05mm
- Excessively long retractions will cause issues by dragging soft filament into cold areas. E3D-v6 hotends need less retraction than most hotends. For direct extrusion systems you should use anywhere from 0.5mm-1.0mm, for bowden systems you might want to go up to 2mm. Retraction beyond 2mm is likely to cause issues.
- The heatsink must be cooled! Heated chambers, fan ducts that restrict flow, and not having the fan running at 100% at all times are common causes of issues. The heatsink should be cool to the touch at all times. If your heatsink is warm to the touch then you have a cooling issue that must be addressed.

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