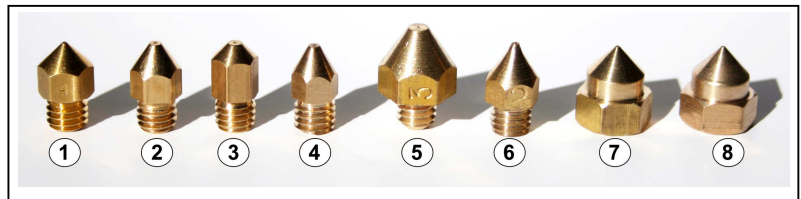


**With so many nozzles to choose from how do you know which one is right for your 3D Printer?**



## Nozzle Styles

Nozzles basically divide into 2 groups : **external thread** and **internal thread**



**External Threaded Nozzles** are more common on desktop machines and are used on Makerbots, PP3D and MBot machines, to name a few. Samples in the photo include Nozzles 1 to 6.

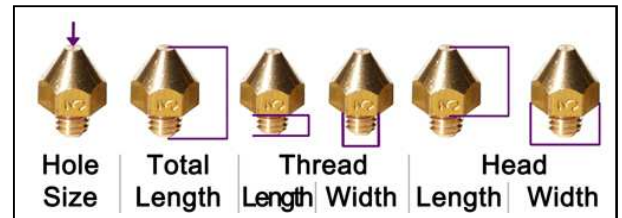


**Internal Threaded Nozzles** were used on the first 3D printers and are continued to be adopted on many “kit” based machines including the Print-A-Bot

## Nozzle Size

Nozzles come in an array of sizes also. They vary in :

- Hole Size
- Head Length
- Head Width
- Thread with/size
- Thread Length



**The hole size determines how thin the filament is extruded.** Makerbot, Mbot and Up machines all extrude at 0.4mm. You can experiment with smaller extrusion however you need software that supports your experiments. Makerware, for example, does not allow you to adjust the nozzle hole size, and as such does not support this style of experimentation, ReplicatorG, on the other hand does.

**The Head Size** influences the heat retention of the nozzle—the wider the head and thus more mass in the head the longer the heat retention. The length influences bed levelling, especially important with Dual extrusion machines were both nozzles HAVE to be exactly the same length.

**The thread size and style** obviously influences the connection to the machine and needs to match perfectly. Most nozzles have a M6 connection (the UP machine being a big exception utilising an M5 connection).

There is a full spec chart on the following pages

## NOZZLE PRICE

There is a huge difference in price across nozzle brands. For example the Makerbot and UP Genuine brand nozzles retail in Australia for \$25+, where as non-genuine brands can be as cheap as \$8. The reality is that many cheaper brands are just as good, just make sure the specs are right for your machine.

## HOW DO I CLEAN IT?

**If you have been printing in ABS** use acetone on a rag to wipe the nozzle clean as required; and soak in acetone over night for a deep clean. Make sure it is in a glass jar with a lid as acetone dissolves plastic (that is why you are using it), and also evaporates—so your jar will be empty in the morning if you do not have a lid.

**If you have been printing in PLA** use Caustic Soda with cold water to soak the nozzle but USE GLOVES and safety gear as directed on the container! Caustic soda is available in supermarkets in Australia look in the cleaning aisle.

## CHANGING A NOZZLE

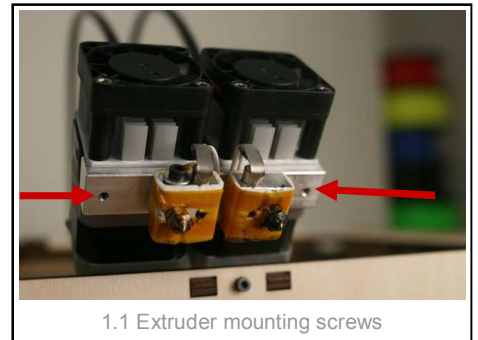
### **NUMBER ONE RULE—Only ever change a nozzle hot!**

This is because it will ensure the heater block has expanded and also soften any filament that may be in the barrel of the nozzle, helping to prevent breaking the nozzle and or heater block.

## STEP 1 : CAN YOU MAKE THINGS EASIER FOR YOURSELF?

**Each machine is a little different**, but if you can lift out the extruder assembly your job will be easier.

In the Makerbot and Mbot machines there are two screws (see Fig 1.1) that are accessed from under the long aluminum mounting block that allow you to lift the whole extruder assembly out. Do this **BEFORE** heating up the nozzle ;)



1.1 Extruder mounting screws

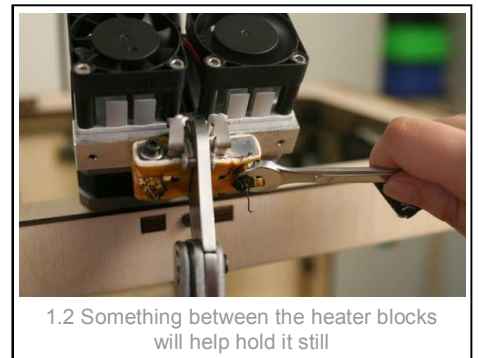
## STEP 2 : PRE HEAT AND REMOVE OLD NOZZLE

Make sure the extruder is on a stable surface and can't slip, and work quickly - metal tools conduct heat. And make sure the nozzle is facing upwards and the heater block is not, for example, resting on your grandmothers wooden table!

Once it's hot, use something to stop the heater block from moving. In a dual machine you can usually do this by putting something between the heater blocks; otherwise use a wrench to grip the heaterblock. (Fig 1.2)

**IMPORTANT** : Many machines have a thermocoupler or thermistor cable coming out the back of the heater block. **DO NOT CRUSH IT** with your wrench.

Use a tool (ie not your fingers!) to undo the nozzle. A M7 spanner is perfect for most nozzles (see the spec chart). It is normal to have some resistance as first. Put aside the old nozzle (again not on grandmas antique table)



1.2 Something between the heater blocks will help hold it still

## STEP 3 : CLEAR BARREL—OPTIONAL

If you have had a faulty thermistor/thermocoupler, or a serious print fail, it is possible your barrel has carbonized filament in it that is just going to block your new nozzle. To flush this out run load with no nozzle on the machine. Watch the filament that comes out—is there brown or black bits in it, or a gouge on the sides. If yes keep loading. The gouge indicates burnt material stuck on the side that is scrapping along your filament.

When it looks clean run unload and put your nozzle on.

## STEP 4 : PUT ON THE NEW NOZZLE

Thread your new nozzle into your heat block (thermal core). You can do this by hand at first

Still holding the thermal cores in place, start to tighten the new nozzle into the hot extruder. When the nozzle is all the way on, it will hit the thermal barrier inside the thermal core. Be careful: it can be hard to tell when you've hit the thermal barrier, **but over-tightening can strip the threads on the nozzle—so don't be a brut about it people!**

## STEP 5 : PUT YOUR MACHINE BACK TOGETHER AND PRINT!

Once you've tightened on the nozzle, bolt the Stepstruder back into place, check your bed height/leveling and print.

**DUAL EXTRUDER MACHINES** : Your nozzle heights need to be even! Bring the platform as far up as it will go and check that the nozzles are at the same height relative to the platform. If they're not, you may have to loosen/tighten one or the other a little—remember do this with them hot!



	Hole Size	Total Length	Thread		Head		Compatible	
			Length	Width	Length	Width	MBI*	MBot UP
① Makerbot	0.4 mm	13 mm	5 mm	5.9 mm	8.5 mm	6.97 mm	✓	✓
② MBot	0.4 mm	13 mm	5 mm	5.7 mm	9.0 mm	6.49 mm	✓	✓
③ BilbyCNC .04	0.4 mm	13 mm	5 mm	5.8 mm	8.0 mm	5.88 mm	✓	✓
④ Up	0.4 mm	12.8 mm	5 mm	5.0 mm	8.2 mm	6.00 mm	✗	✓
⑤ 0.3 Wide	0.3 mm	15.5 mm	5 mm	5.8 mm	10.4 mm	10.0 mm	✓**	✓**
⑥ 0.2 Standard	0.2 mm	13.3 mm	5 mm	5.7 mm	8.9 mm	6.95 mm	✓**	✓**
⑦ 0.05 (internal thread)	0.5 mm	12 mm	-	-	12 mm	10.0 mm	✗	✗
⑧ 0.34 (internal thread)	0.34 mm	12 mm	-	-	12 mm	11.5 mm	✗	✗

\*MBI = Makerbot Industries

\*\* Experimental only, use ReplicatorG NOT Makerware

