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Pack 07

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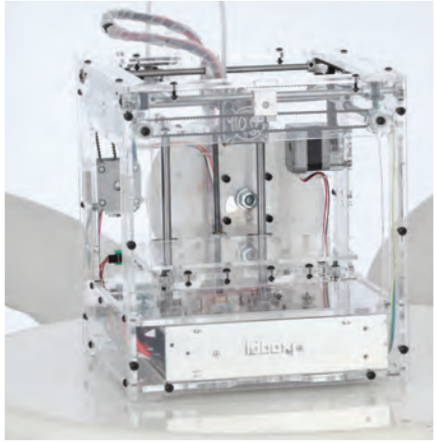
BUILD YOUR OWN idbox! 3D PRINTER



CONTENTS

WARNING: Not suitable for children under the age of 14. This product is not a toy and is not designed or intended for use in play. Items may vary from those shown.

DeAGOSTINI MODEL SPACE™

www.model-space.com

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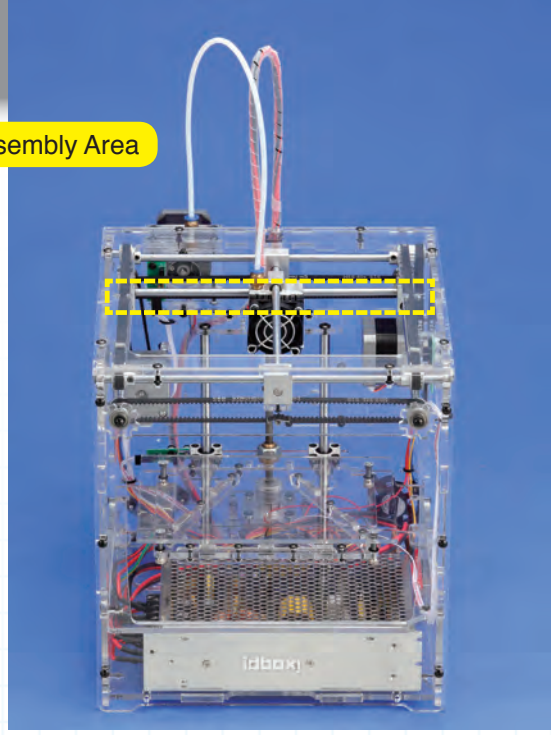
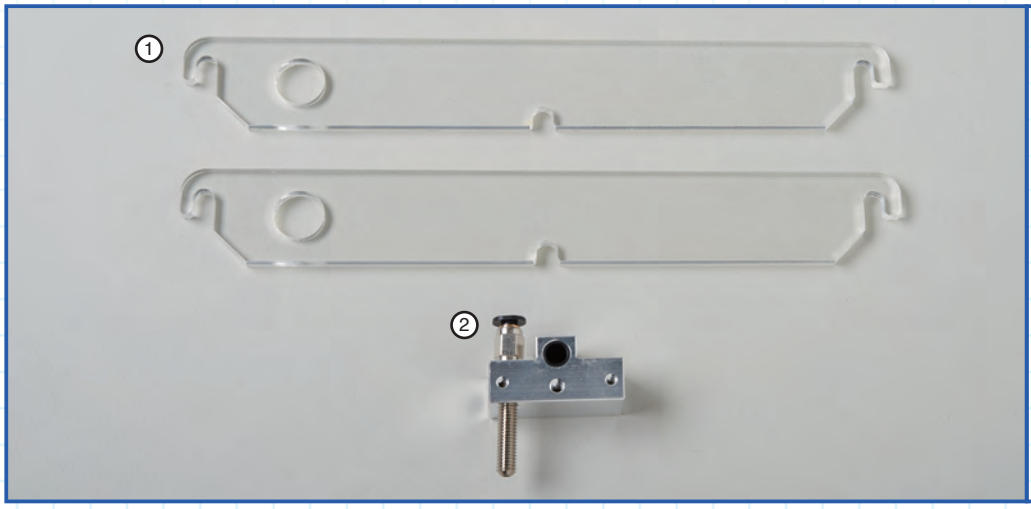


Stage 26: Adjust the positions of the left and right sliders

In this stage, you use the two acrylic jigs supplied to position the left and right sliders on their slider rods, after you've inserted the head rod that links them. Be careful not to scratch or bend the head rod while you are working.

You'll have to loosen the set screws (using the 2mm Allen key) that hold three of the short timing pulleys onto their slider rods before you can adjust the position of the sliders. Then you pass a head rod through the holes in the left right sliders and set the position of the sliders accurately with the jigs. Remember that the end of the rod on the same side as the limit switch must not protrude from the slider, or the limit switch might get damaged during operation of the printer.



Stage 26 Components

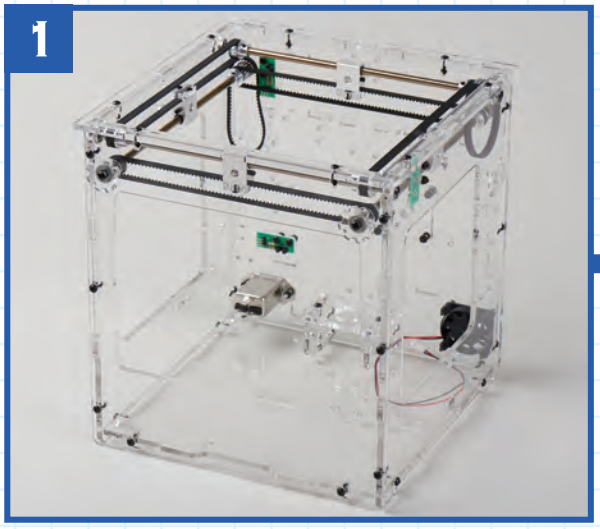
1: Slider positioning jigs x 2
2: Head block

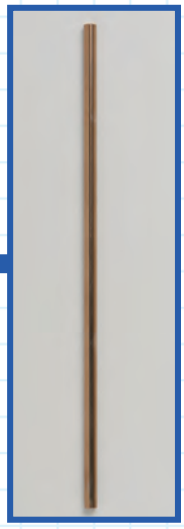
Tools you will need

Allen key (2mm) supplied with Stage 11

Parts to have ready

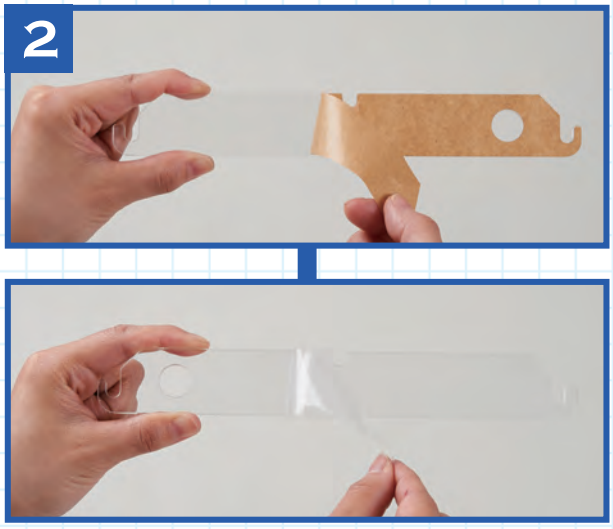
1





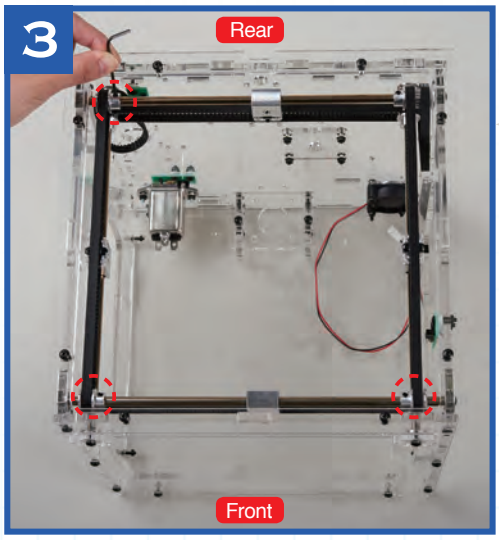
Take the housing as assembled so far, and the head rod supplied with Stage 24 (or the one supplied with Stage 25; they're identical).

2



Peel the protective layers off both sides of both the slider positioning jigs.

Loosen the set screws of the short timing pulleys

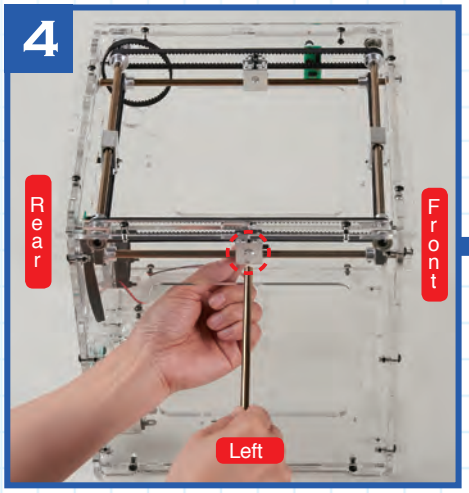


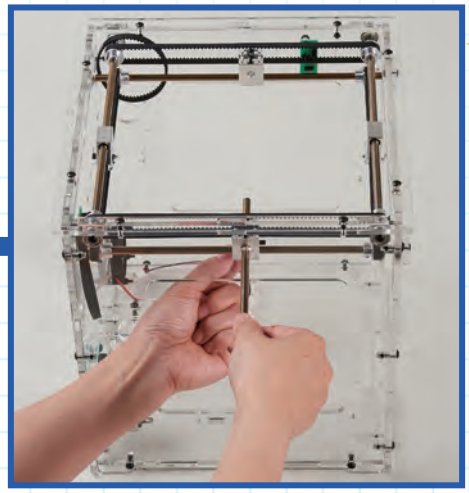
HINT

If it's difficult to get the Allen key into a set screw, move the slider to make this easier.

Loosen the set screws in the three short timing pulleys (shown left, ringed in red) by turning their screws slightly counterclockwise with the 2mm Allen key.

Adjust the slider positions





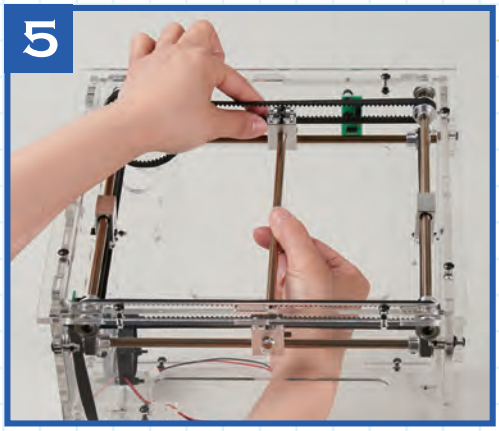
POINT

Hold the slider so that its side is at a right angle (90 degrees) to the rod, or the rod will not go in easily.

Correct

Incorrect

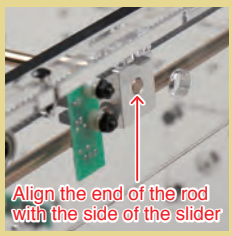
With the left panel of the housing facing you, insert the head rod through the hole in the housing (ringed in red, above), then through the hole in the slider. Hold the slider steady with one hand while you insert the rod with the other.



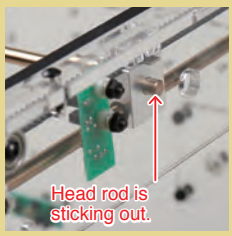
POINT

Do not let the end of the head rod protrude from the slider, as it might hit and damage the limit switch.

Correct

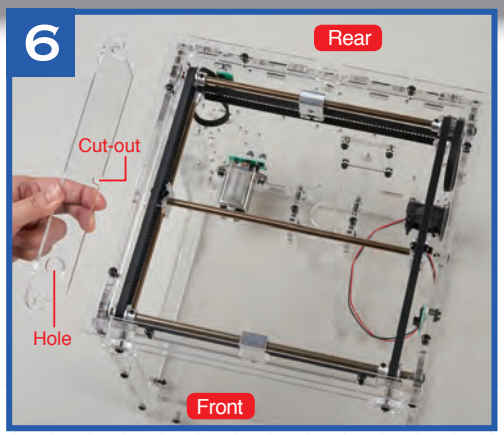


Incorrect



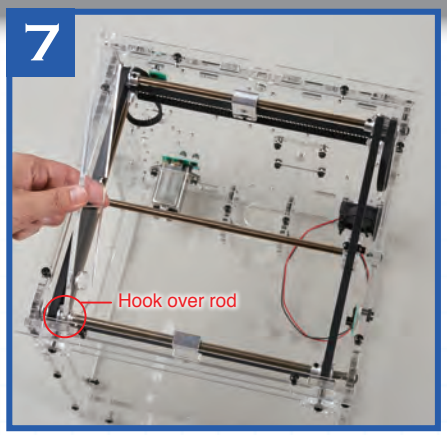
Keep pushing the rod through the hole until it reaches the hole in the slider opposite, then insert it into the hole in the opposite slider. If the opposite slider does not align, move it from side to to side; you can do this because the pulley set screws have been loosened.

6



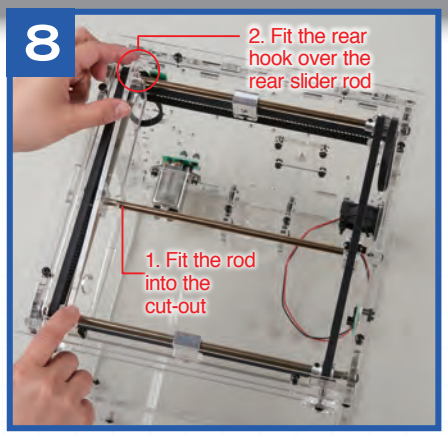
With the front of the housing facing you, hold one of the jigs so that the large hole is closer to you and the small cut-out is at the bottom.

7



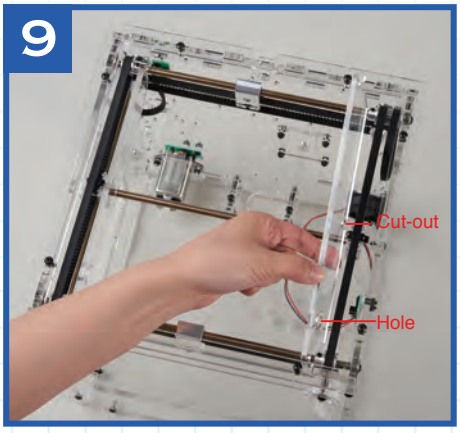
Fit the hook on the end of the jig over the left of the slider rod closest to you, just to the right of the timing pulley.

8



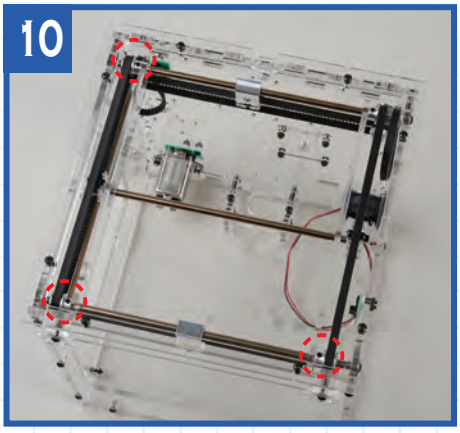
Fit the head rod into the cut-out on the jig, moving the rod back or forward as necessary. Then fit the jig's rear hook over the left end of the rear slider rod.

9



Fit the other jig in the same way to the right side of the assembly.

10

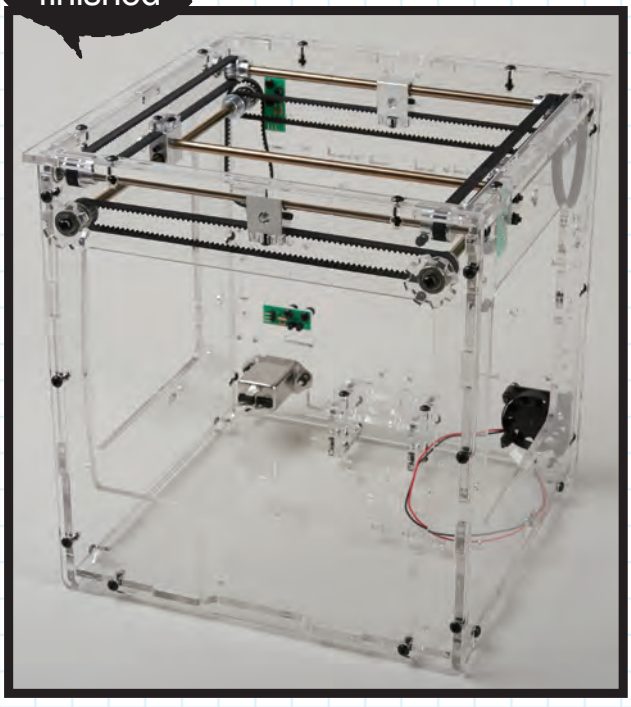


Tighten the three set screws you loosened in Step 3, to set the position of the timing pulleys and the sliders.

HINT

Don't try to force the head rod into the groove on the underside of the jig; simply move the position of the slider until it slots in.

Stage finished

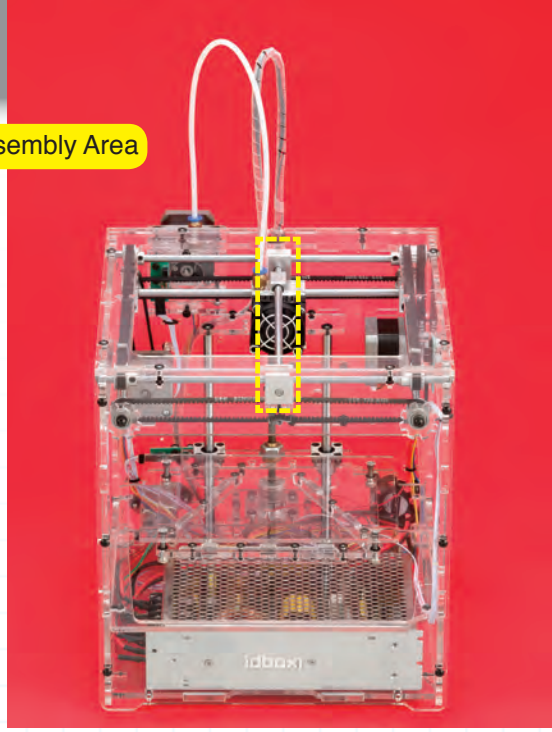


The positions of the left and right sliders have now been set accurately. In the next stage, use the jigs again to do the same for the front and back sliders.

Store the parts

Keep the head block safe for use later.

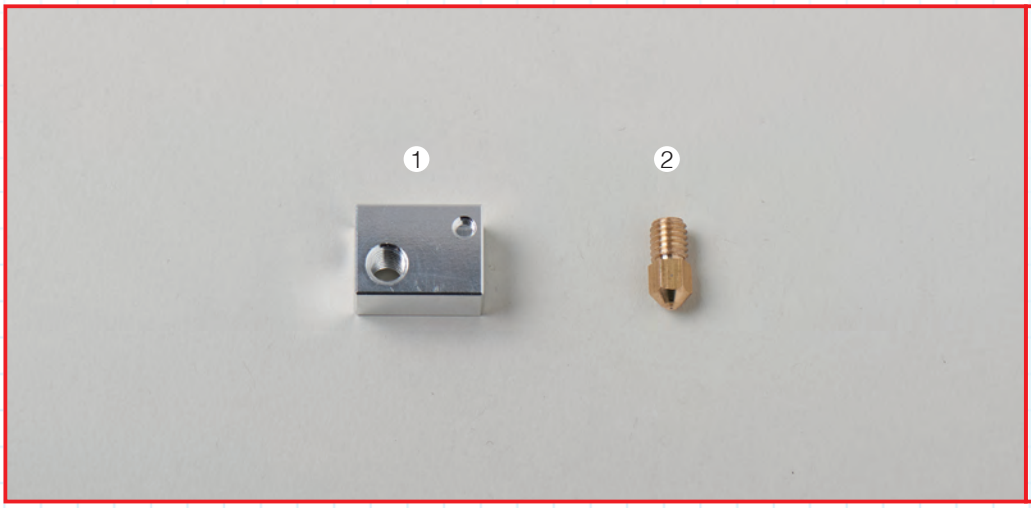
Stage 27 Assembly Area



Stage 27: Use the jigs to adjust the front and rear sliders

In this stage, you add the other head rod, which connects the front and rear sliders. It is passed through a hole in the housing and into holes in the sliders, before adjusting the slider positions using the jigs. This time, the jigs are used from below the rods.

As in the previous stage, you first have to loosen the set screws holding three short timing pulleys onto their slider rods. After that, the remaining head rod is inserted into holes in the front and back sliders via a hole in the rear panel of the housing. Make sure the head rod does not protrude from the back of the rear slider, as it will hit and damage the limit switch.



Stage 27 Components

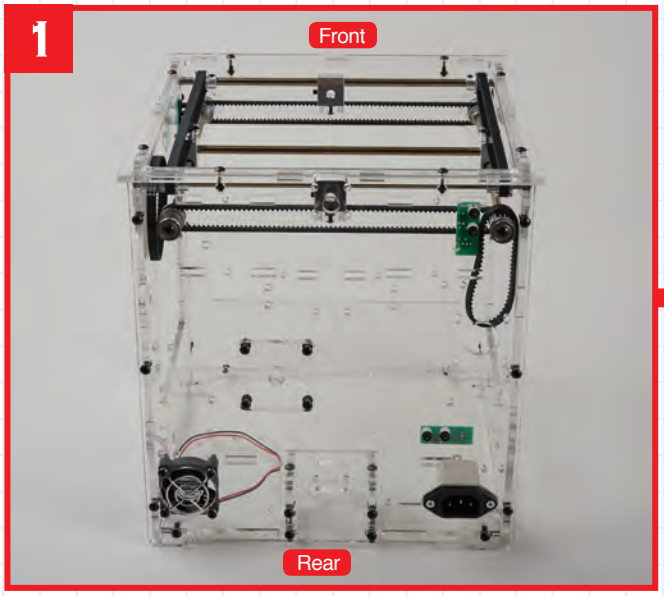
1: Heater block × 1
2: Nozzle × 1

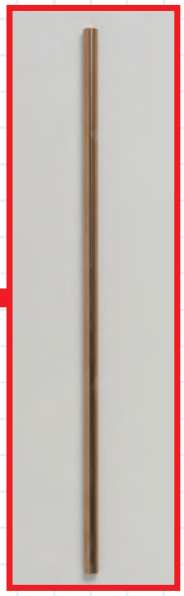
Tools you will need

Allen key (2mm) provided with Stage 11

Parts to have ready

1

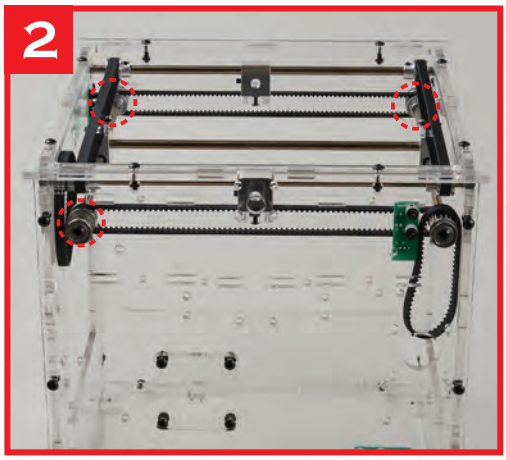




Take the housing as assembled so far. Turn it so that the rear is facing you. You will also need the head rod that was supplied with Stage 25 – remember to keep the rod clean and avoid getting it scratched.

Adjust the position of the front and rear sliders

2

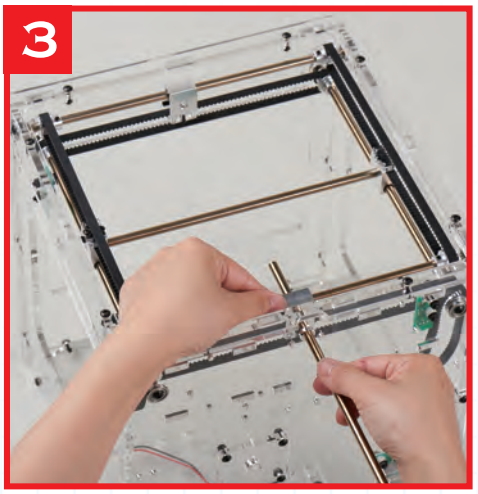


Loosen the set screws in the three lower short timing pulleys, shown above ringed in red, by turning their set screws slightly counterclockwise with the 2mm Allen key.

HINT

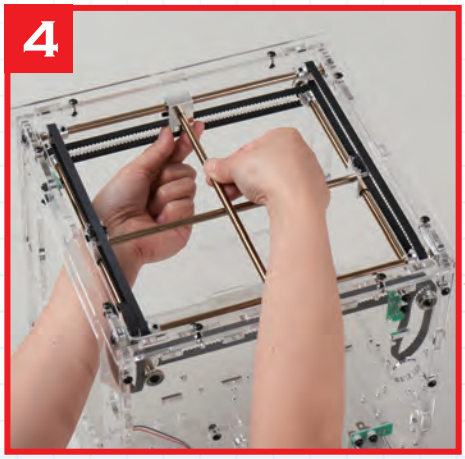
If it's difficult to get the Allen key into a set screw, move the slider to make this easier.

3



Insert the head rod through the hole in the rear of the housing, then through the hole in the slider.

4

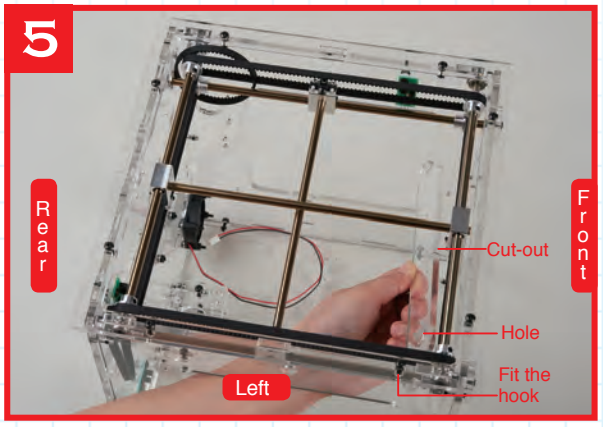


Keep on pushing the rod through the hole until it reaches the hole in the slider opposite and insert it into that slider's hole. If the opposite slide does not align, move it from side to side.

Caution

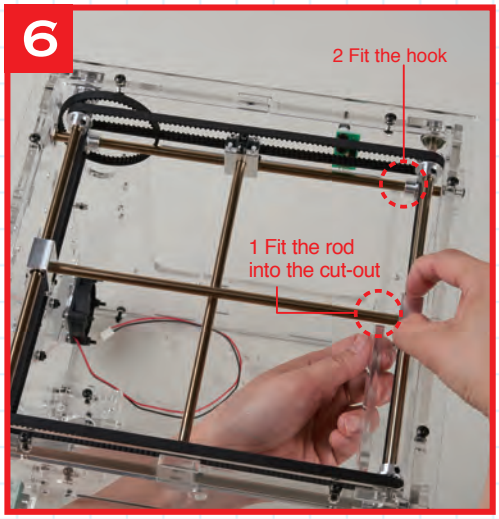
Do not let the end of the head rod protrude from the rear slider, as it might hit and damage the limit switch.

5



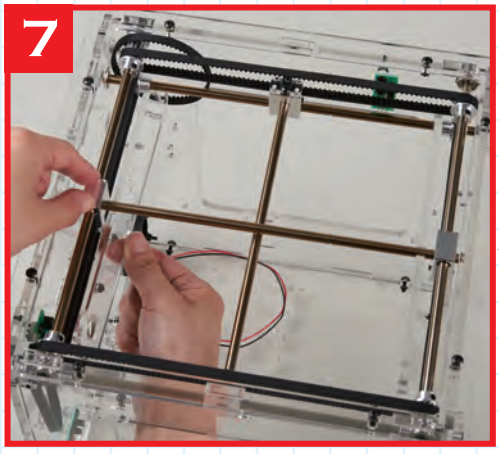
Turn the housing so the left side is facing you and get one of the jigs ready. With the hole in the jig closest to you and the cut-out uppermost, fit the jig hook closest to you onto the right end of the slider rod from below.

6



First, adjust the position of the slider so the head rod fits into the cut-out on the jig. Second, fit the rear hook onto the slider rod opposite from below.

7

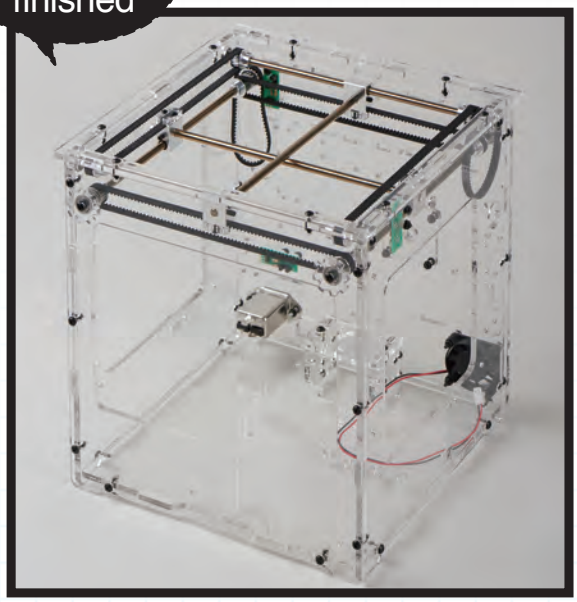


HINT

Don't try to force the head rod into the groove on the upper side of the jig – simply move the position of the slider until it slots in.

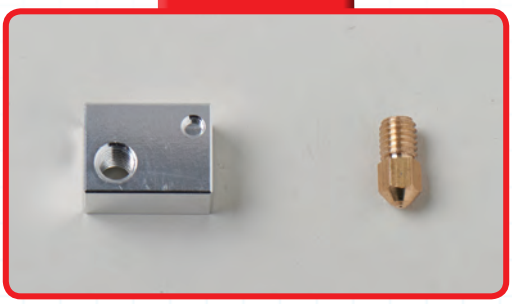
Fit the other jig in the same way to the other side of the assembly. With the jigs in place, tighten the three set screws you loosened in Step 2 to fix the pulleys and accurately set the positions of the sliders. Remove the jigs once the timing pulley set screws have been tightened.

Stage finished



The positions of the front and back sliders have now been set accurately.

Store the parts



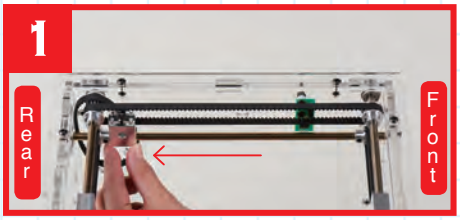
Keep the heater block and the nozzle safe, as they will be used in the next stage.

Adding torsion springs

The torsion springs (supplied with Stage 25) are for use when the timing belts begin to loosen with age. They should not be installed if the belts have not become loose, as their installation might cause damage to the housing.

Here, the method for installing a torsion spring on the timing belt on the right side of the Y-axis is shown as an example of how the springs are fitted. When it is time to fit the belts, fit all four of the torsion springs – one to each timing belt – to maintain even tension in the belts.

1

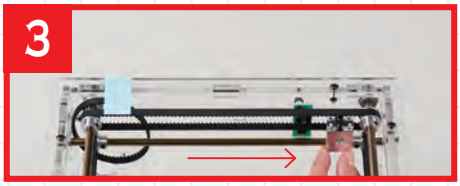


Place the housing so its left side is facing you. Slowly move the slider leftwards to the end of its rod, as shown.

2

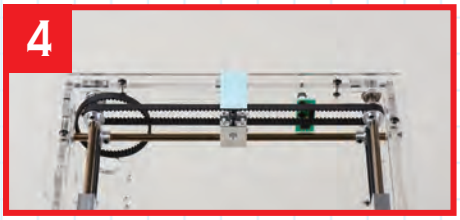
Mark the position where the spring is likely to go with some 2cm-wide tape on the right of the timing belt. Put the tape a couple of millimetres in from the pulley.

3



Slowly move the slider all the way to the right. Adjust the distance between the marker and the pulley so it is the same as it was when it was on the other side.

4



Move the slider so the marker is exactly above it. Remove the marker.

5

You will attach the torsion spring exactly above the slider. Put the coil of the V-shaped spring on the top of the belt.

6

Hook one of the torsion spring's arms under the timing belt.

7

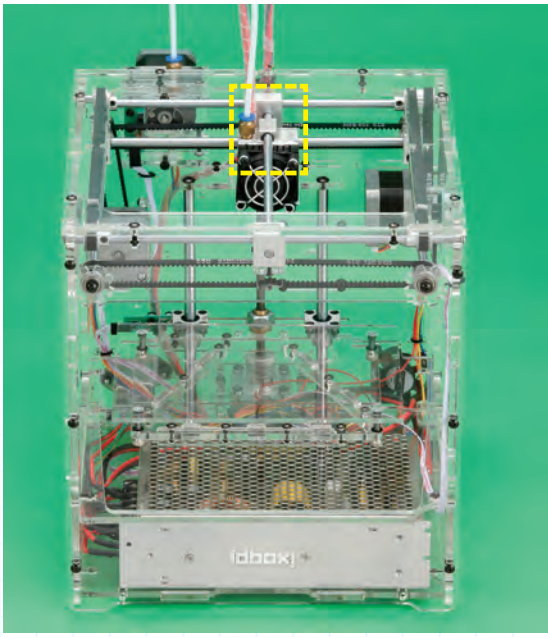
Hook the other arm of the torsion spring under the belt as shown. After installation, move the slider to the left and right to check that the spring does not hit either of the pulleys. The left side Y-axis spring is mounted in the same way. The X-axis springs are added to the timing belts in a similar way, but with the springs below the sliders.

Caution

During assembly, the tip of the spring might hurt your fingers, so take care. If you find it hard to put the spring on, try using some long-nose pliers.

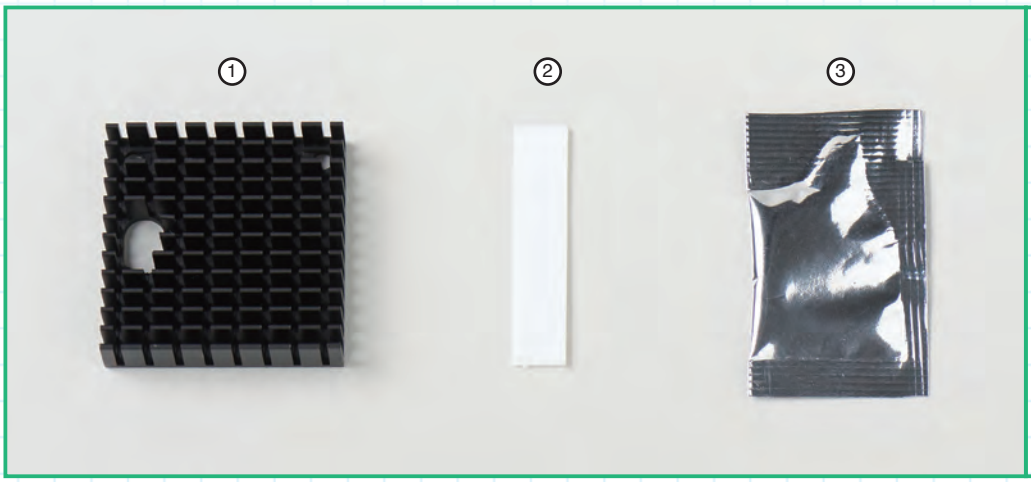
Stage 28 Assembly Area

Stage 28: Add the heater block to the head block cylinder, then attach the nozzle



In this stage, you begin work on the head, one of the most important components of your idbox. The first thing to do is to attach the heater block to the cylinder, then you add the nozzle to the heater block.

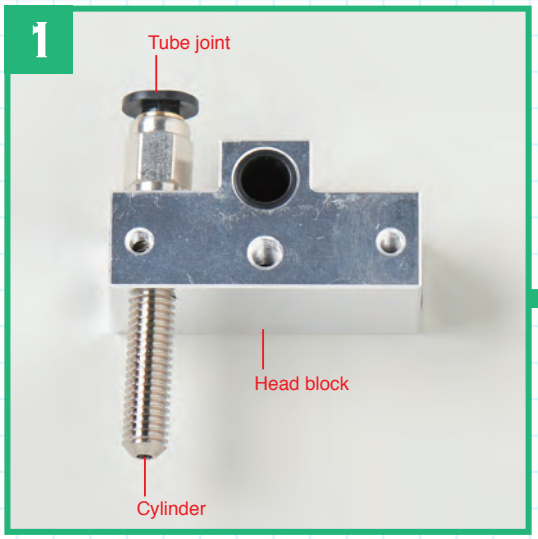
The head block that was supplied with Stage 26 comes pre-assembled with the cylinder and the tube joint. This time, you add the heater block, which screws onto the cylinder, then the nozzle, which screws into the heater block. You do not need any tools for the assembly described in this stage, as all the work is done by hand. Make sure you screw the heater block on the right way round and that you leave the correct gap between the head of the nozzle and the heater block.

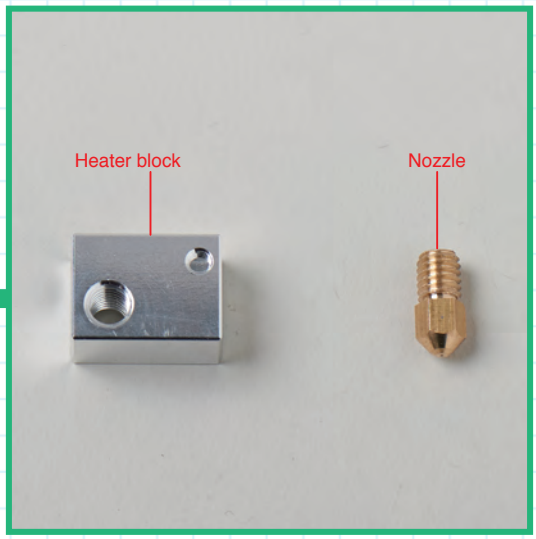


Stage 28 Components

1: Heat sink × 1
2: Fan draught blocking strip × 1
3: Thermal grease × 1

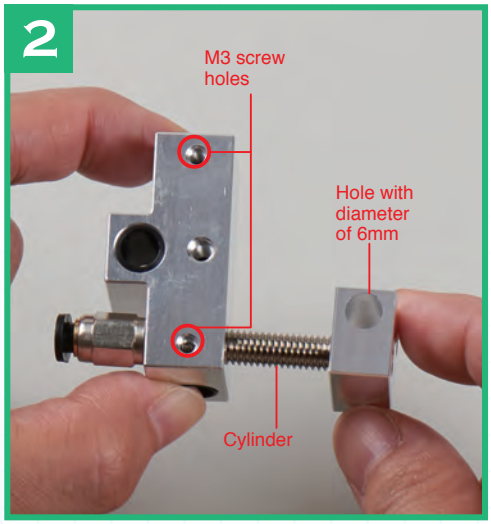
Parts to have ready





Get ready the head block, supplied with Stage 26, and the heater block and nozzle supplied with Stage 27.

Screw the heater block to the cylinder



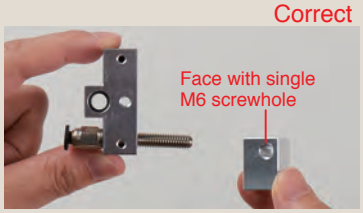
Hold the head block and the heater block as shown above, so that the two M3 screw holes on the head block are facing you and the cylinder is on the right. The heater block has the 6mm diameter unthreaded hole facing you at the top of the block (see the Hint box on the right).

Insert the threaded cylinder into the threaded screw hole in the heater block and rotate the heater block through three complete revolutions clockwise to screw it on.

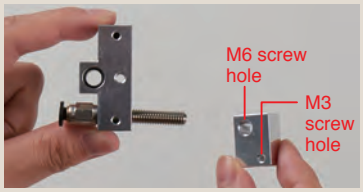
HINT

On one face of the heater block, there are two screw holes, one M6 size and one M3. On the other side is just one, M6 size. The cylinder is inserted into the face with the single M6 screwhole.

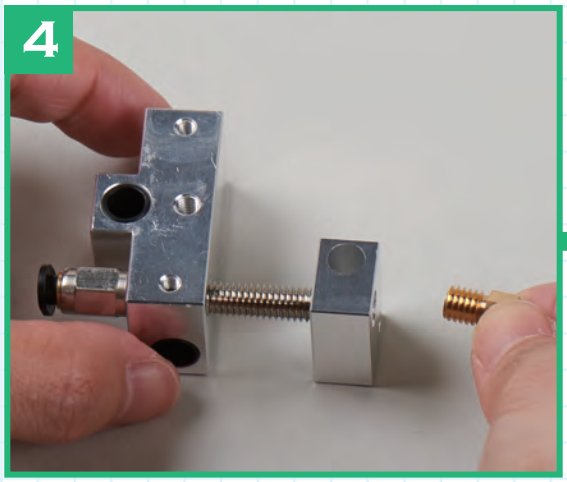
Correct

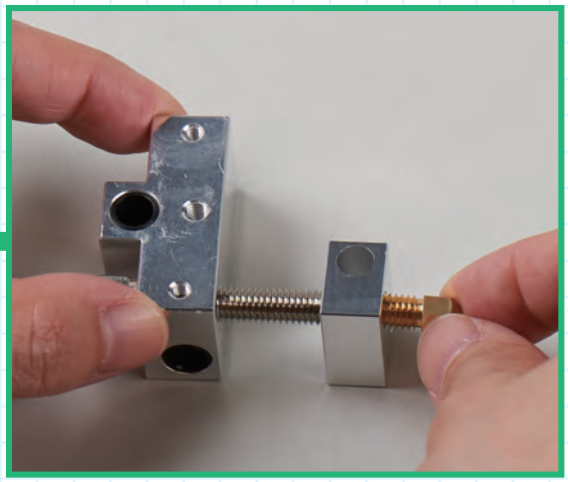


Incorrect



Add the nozzle to the heater block





Screw the nozzle into the heater block with your fingers.

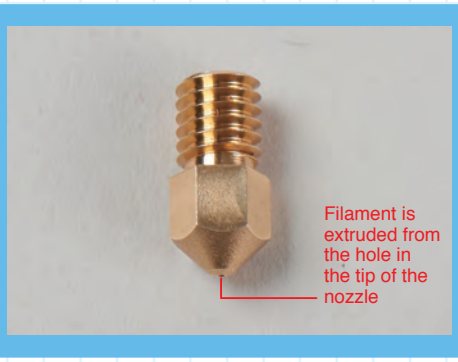
HINT

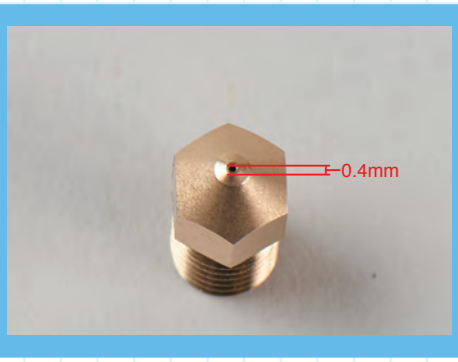
Turn the nozzle until it touches the end of the cylinder inside the heater block and cannot be turned any more.

About the nozzle

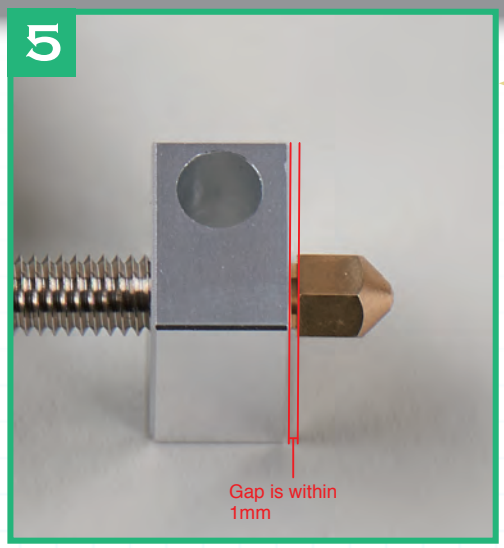
CLOSE-UP

Have a close look at the nozzle and you'll see that it has a chamber on the inside and a small hole in its tip. This hole in the nozzle has a diameter of 0.4mm. Filament for making the 3D object passes through the cylinder from the tube joint and into the nozzle. The filament becomes soft at high temperatures and is pushed out from the tip of the nozzle.





5

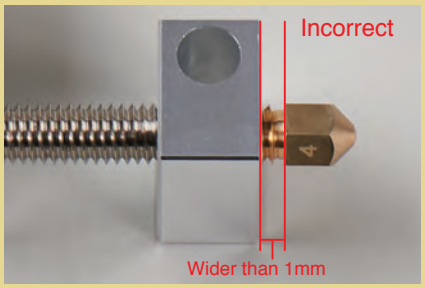


The gap between the heater block and the head of the nozzle should be about 1mm.

POINT

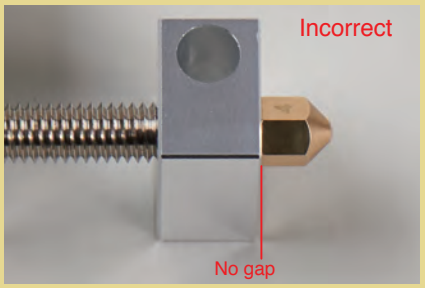
If the gap between the heater block and the head of the nozzle is either non-existent or more than about 1mm, it must be adjusted (as described below). If the gap is not correct, there might be problems: the nozzle might get clogged, filament might leak from the assembly, or the models might not print properly.

If the gap is wider than 1mm



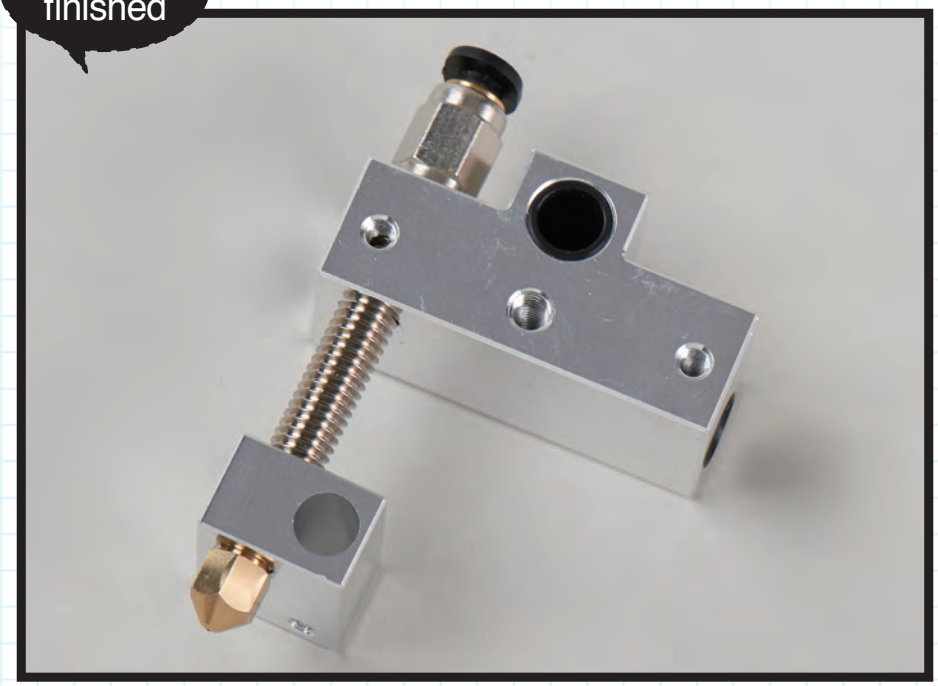
To narrow the gap, loosen the nozzle, rotate the heater block by one turn counterclockwise and then retighten the nozzle by hand until it does not turn anymore.

If there is no gap



To widen the gap, loosen the nozzle, rotate the block by one turn clockwise, then tighten the nozzle firmly by hand until it does not turn any further.

Stage finished



The heater block and nozzle have been temporarily fixed to the head block by being screwed onto the cylinder. In the next stage, you add the heat sink and cooling fan to the head block.

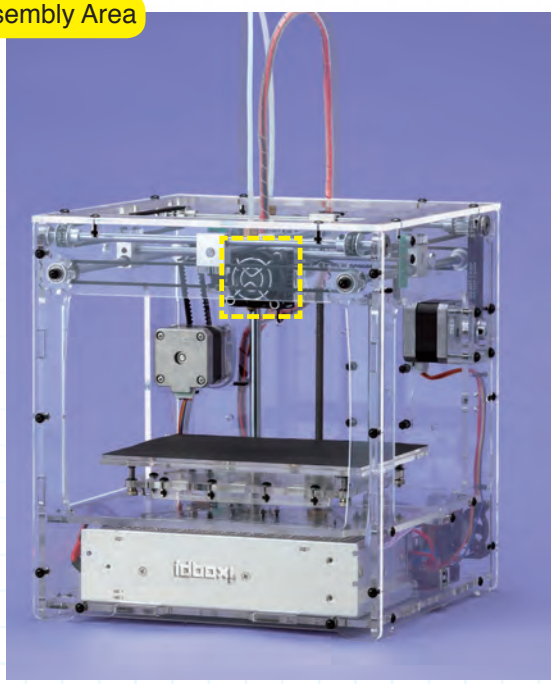
Tighten the nozzle when it is hot

It will be necessary to tighten the nozzle after the idbox has been completed. If the nozzle is tightened up when the printer head is cold, thermal expansion will loosen it when the heater block heats up, leading to problems such as filament leakage. The nozzle will need to be tightened with a spanner before the printer is used, when the printer head is at a working temperature of between 170 and 200 degrees Celsius. Always take great care when working with hot components.

Store the parts

Keep the heat sink, fan draught blocking strip and thermal grease safe for use later.

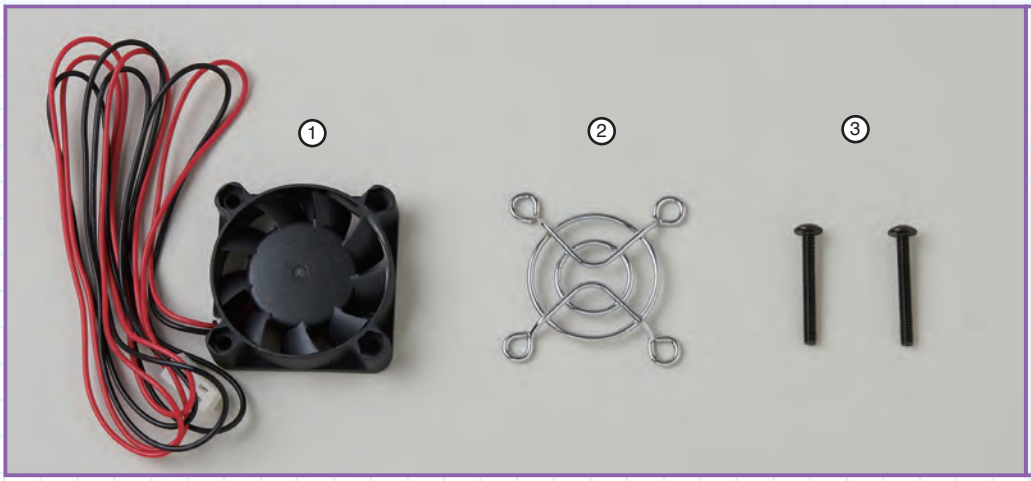
Stage 29 Assembly Area



Stage 29: Attach the heat sink and cooling fan to the head block

In this stage, you add a heat sink and cooling fan to the head block. The heat sink protects the head block from excess heat, and the fan cools the plastic after it has been extruded from the nozzle.

The head block, which you assembled in Stage 28, is partly painted with thermal grease before you add the heat sink. Next, you add the draught blocking strip to the fan. Then the cooling fan and the fan guard are fixed in place using two 26mm M3 truss-head screws. It's a good idea to have a dry run (without the grease) to see how the components go together before you do it for real, with the grease.



Stage 29 Components

1: Cooling fan × 1
2: Fan guard × 1
3: M3 truss-head screws (26mm) × 2

Tools you will need

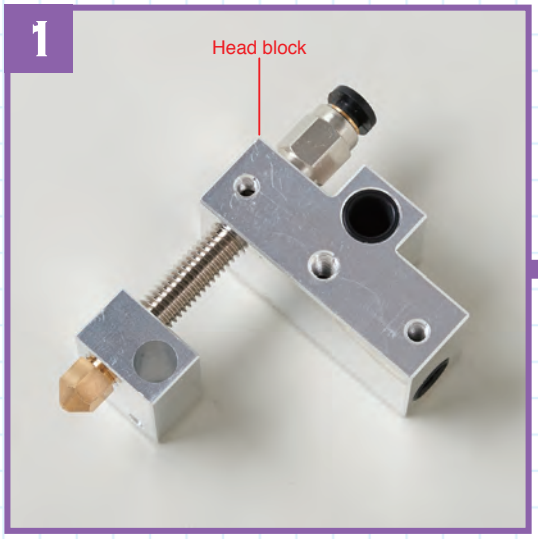
Phillips screwdriver (size 1)

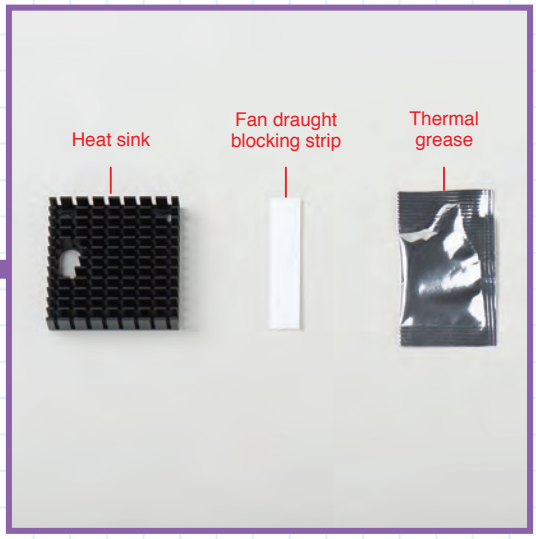
Useful Items

Cocktail stick or toothpick

Parts to have ready

1





As well as the parts supplied with Stage 29, get ready the head block assembly and the heat sink, the fan draught blocking strip and thermal grease supplied with Stage 28.

Apply thermal grease to the head block, then add the heat sink

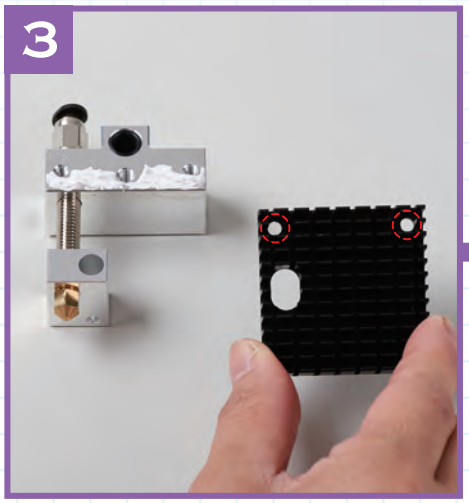
2

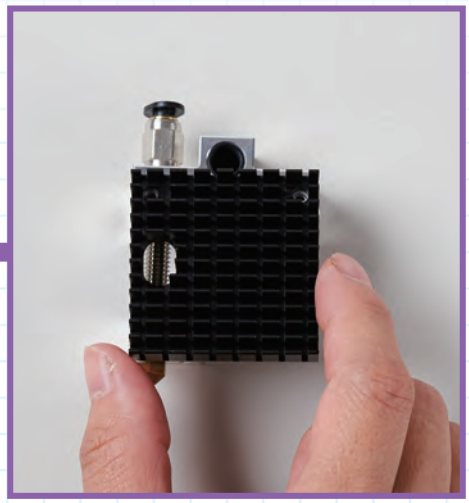
With the two M3 screw holes in the head block uppermost, apply thermal grease to the area of the head block shown above right.

HINT

Squeeze some of the thermal grease onto some unwanted card or paper and apply it with a toothpick or cocktail stick.

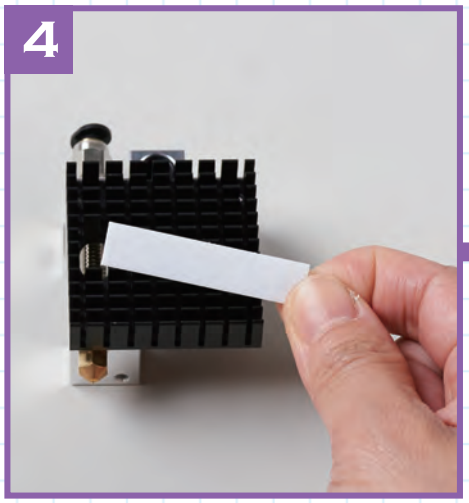
3

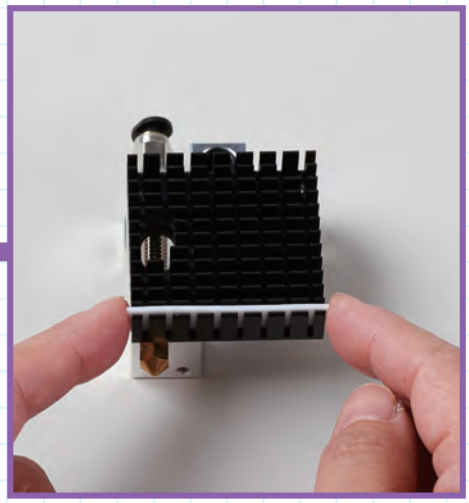




Line up the two holes on the heat sink (ringed in red in the photo above left) with the two screw holes in the head block, and place the flat side of the sink onto the head block.

4





Place the fan draught blocking strip in the heat sink so that it sits in the slot formed by the last row of fins.

CLOSE-UP

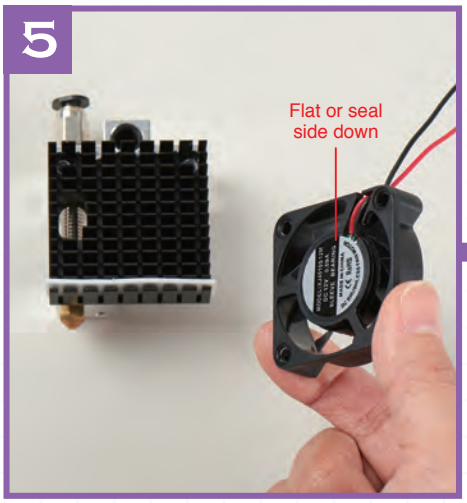
Fan draught blocking strip

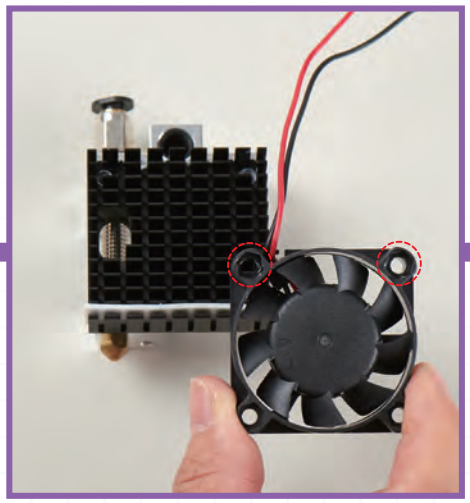
Both PLA and ABS can be used in the idbox, but the melting temperatures of the two plastics are different. Depending on the product, PLA has a melting temperature of between 190 to 210 degrees Celsius, while ABS's is between 200 and 250 degrees Celsius.

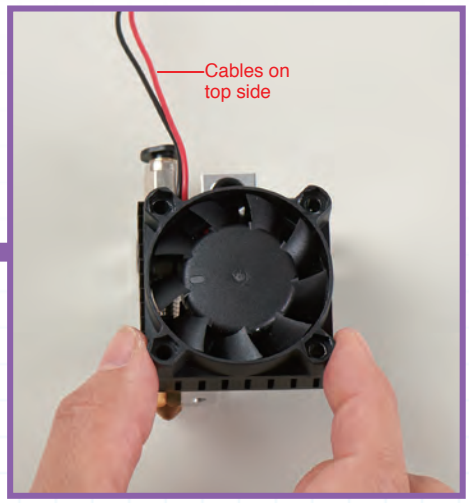
If you are using low-melting point PLA, it can benefit from being cooled, so the fan draught blocking strip can be left off. When using ABS, you can reduce the likelihood of shrinking and warping by using the fan draught blocking strip.

Screw the fan and fan guard to the head block

5

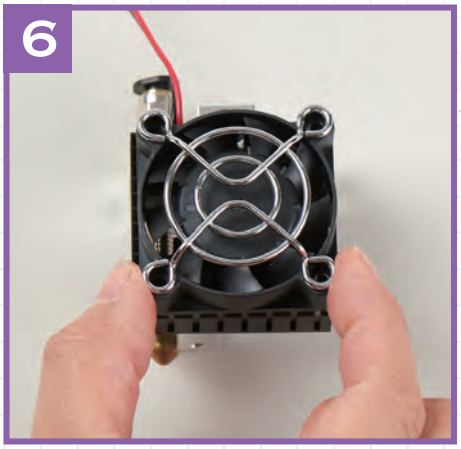






Hold the cooling fan so its flat underside faces the heat sink, and line up the two holes ringed in red (centre photo) with the holes in the heat sink, making sure that the fan cables are at the top, as shown.

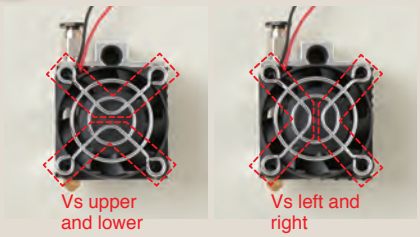
6



Position the fan guard as shown, so its slightly domed side is on the outside. Line the loops up with the holes in the fan.

HINT

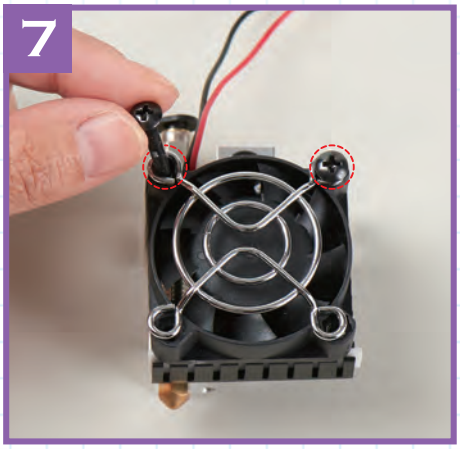
The V-shapes of the guard can be in either of the orientations below.



HINT

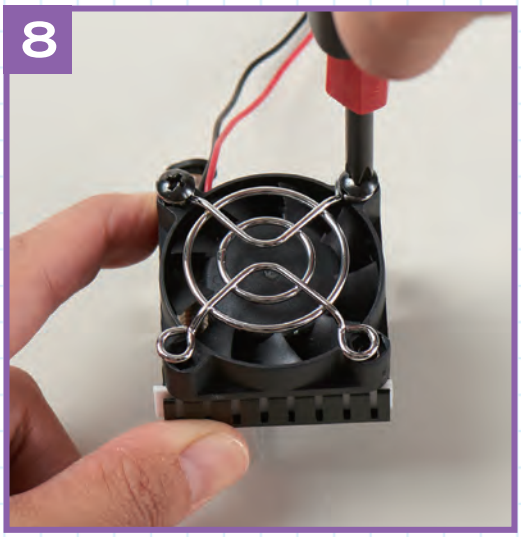
If any of the thermal grease is visible after you've tightened the screws, wipe it off.

7



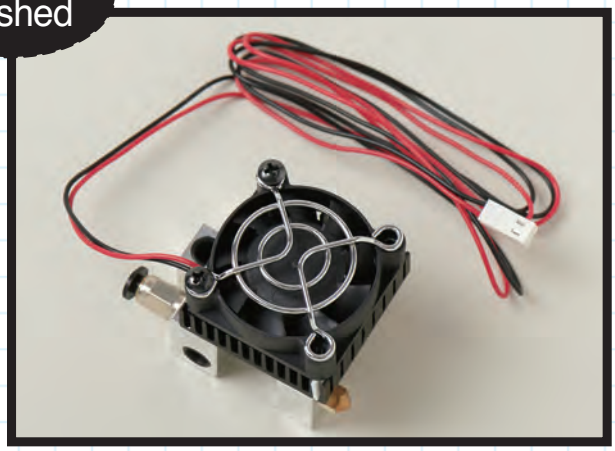
Put two 26mm M3 truss-head screws in the holes in the head block (shown) to connect the fan guard, fan and heat sink. Tighten both screws.

8



Tighten each screw in turn until they are both tight.

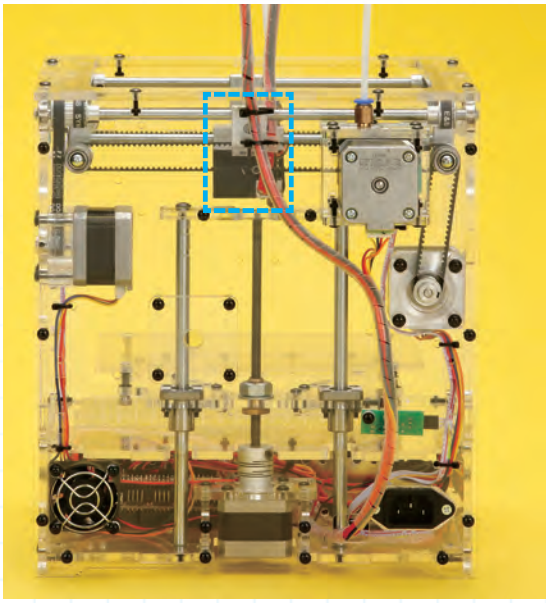
Stage finished



The heat sink and cooling fan are now attached to the head block. In the next stage, you add the heater.

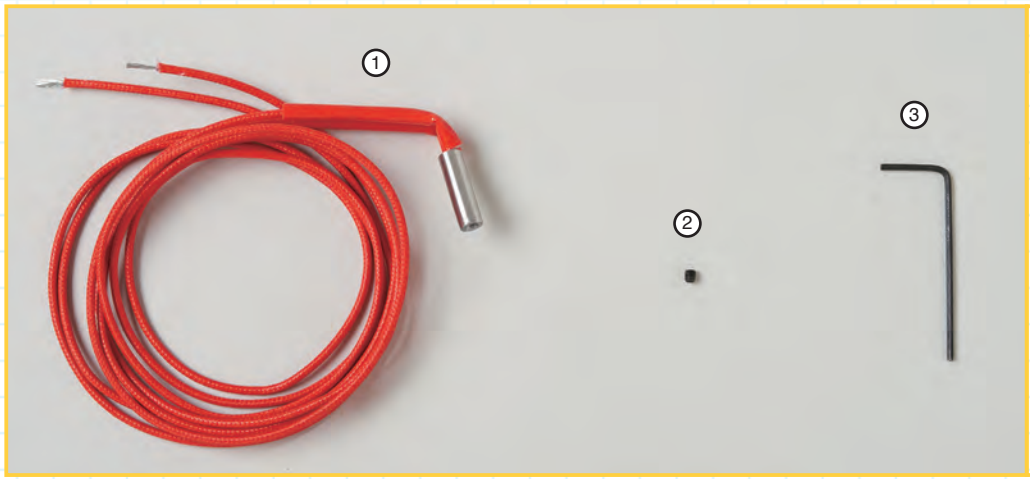
Stage 30 Assembly Area

Stage 30: Add the heater to the head block assembly



In this stage, you insert the heater cartridge into a hole in the heater block and hold it in place temporarily with a small set screw. The screw has to be tightened only enough to hold the cartridge in position, as this will be adjusted later.

You will need the head block assembly – last worked on in Stage 29 – so you can put the metal section of the cartridge heater into the hole in the heater block. Next, use the 1.5mm Allen key, supplied with this stage, to tighten the small M3 3mm set screw loosely, so that it holds the cartridge heater. The set screw is very small, so take care not to lose it during the assembly process.



Stage 30 Components

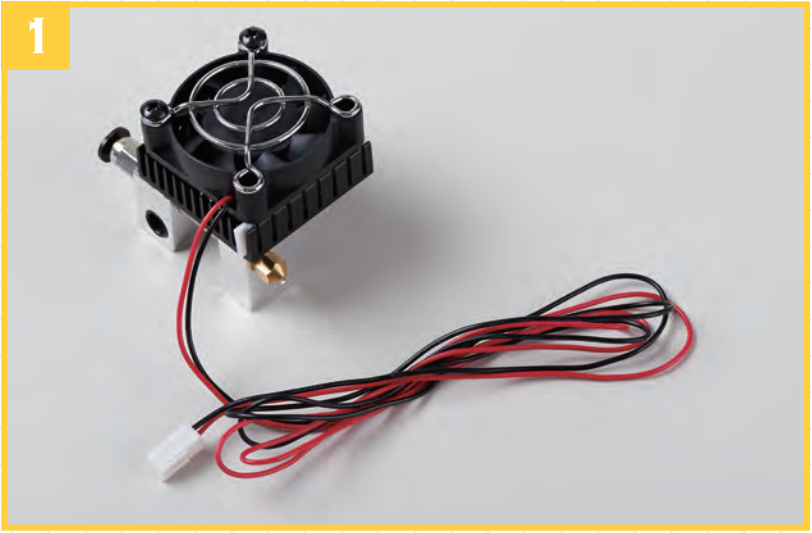
1: Cartridge heater × 1
2: M3 set screw (3mm) x 1
3: Allen key (1.5mm) x 1

Tools you will need

Allen key (1.5mm) supplied with this stage.

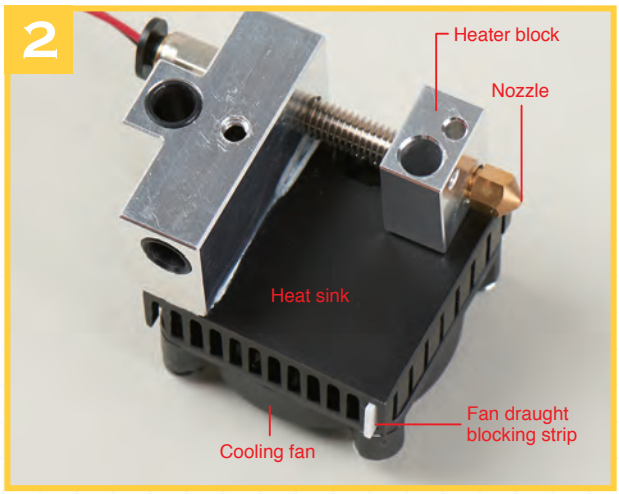
Parts to have ready

1

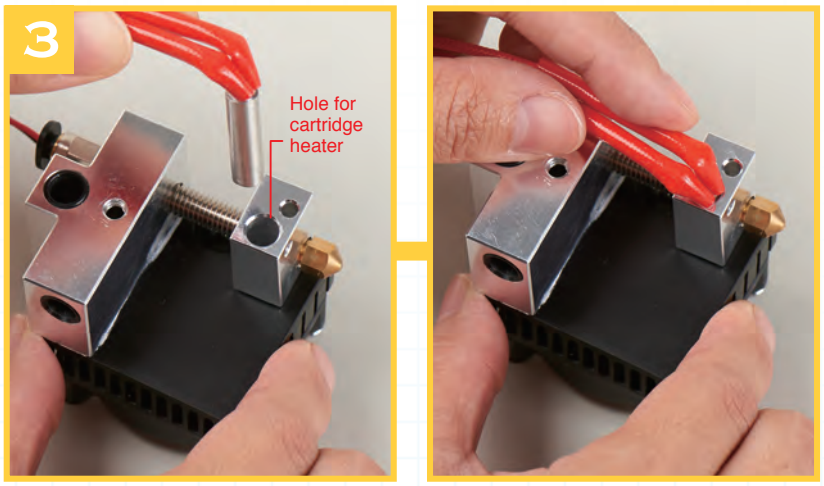


You will need the printer head assembly.

Insert the cartridge heater into the hole in the heater block

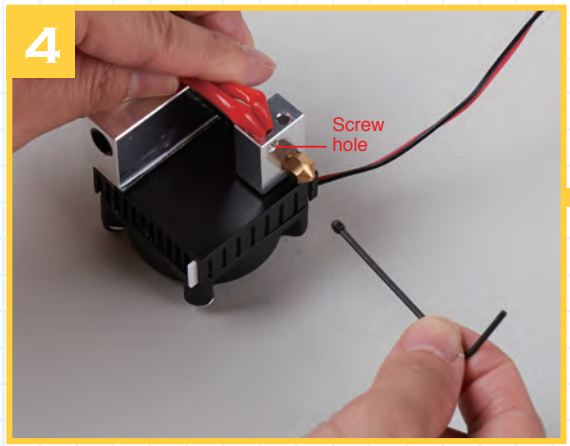


Prepare the head block assembly so the nozzle is on the right and the heater block is uppermost, as shown above.



Insert the metal part of the cartridge heater into the larger of the two holes in the heater block.

Put in the set screw



HINT

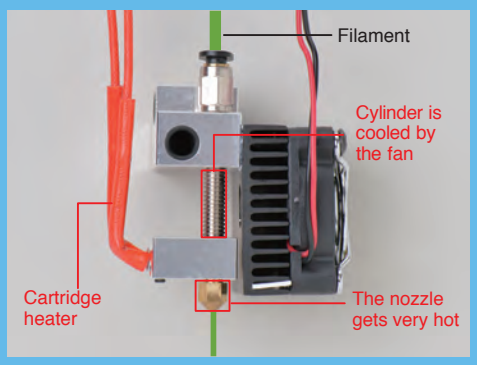
The cartridge heater will be adjusted at a later stage, so screw in the set screw only enough to hold it in place for now. Do not fully tighten it.

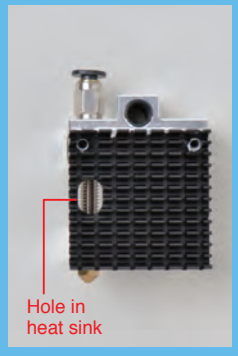
Insert the long end of the 1.5mm Allen key into the hexagonal hole in the 3mm set screw, and screw it into the hole next to the nozzle on the heater block.

CLOSE-UP

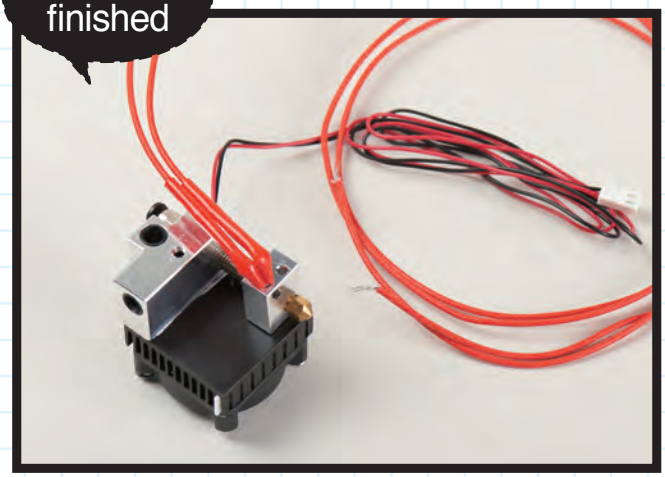
Heating the head assembly

The filament is heated by the cartridge heater in the head assembly and softens inside the nozzle before being extruded through the hole in the tip of the nozzle. During operation, heat is conducted along the cylinder, but if the temperature in the cylinder is too high, the extrusion process will not work efficiently. To combat this, the heat sink and cooling fan attached to the head block help to keep the temperature in the cylinder down, so too does the fan that blows directly onto the cylinder through the hole in the heat sink.





Stage finished



The cartridge heater has been inserted into its hole in the heater block and held temporarily in place with a set screw. In the next stage, a thermistor is added that helps to control the temperature of the nozzle.

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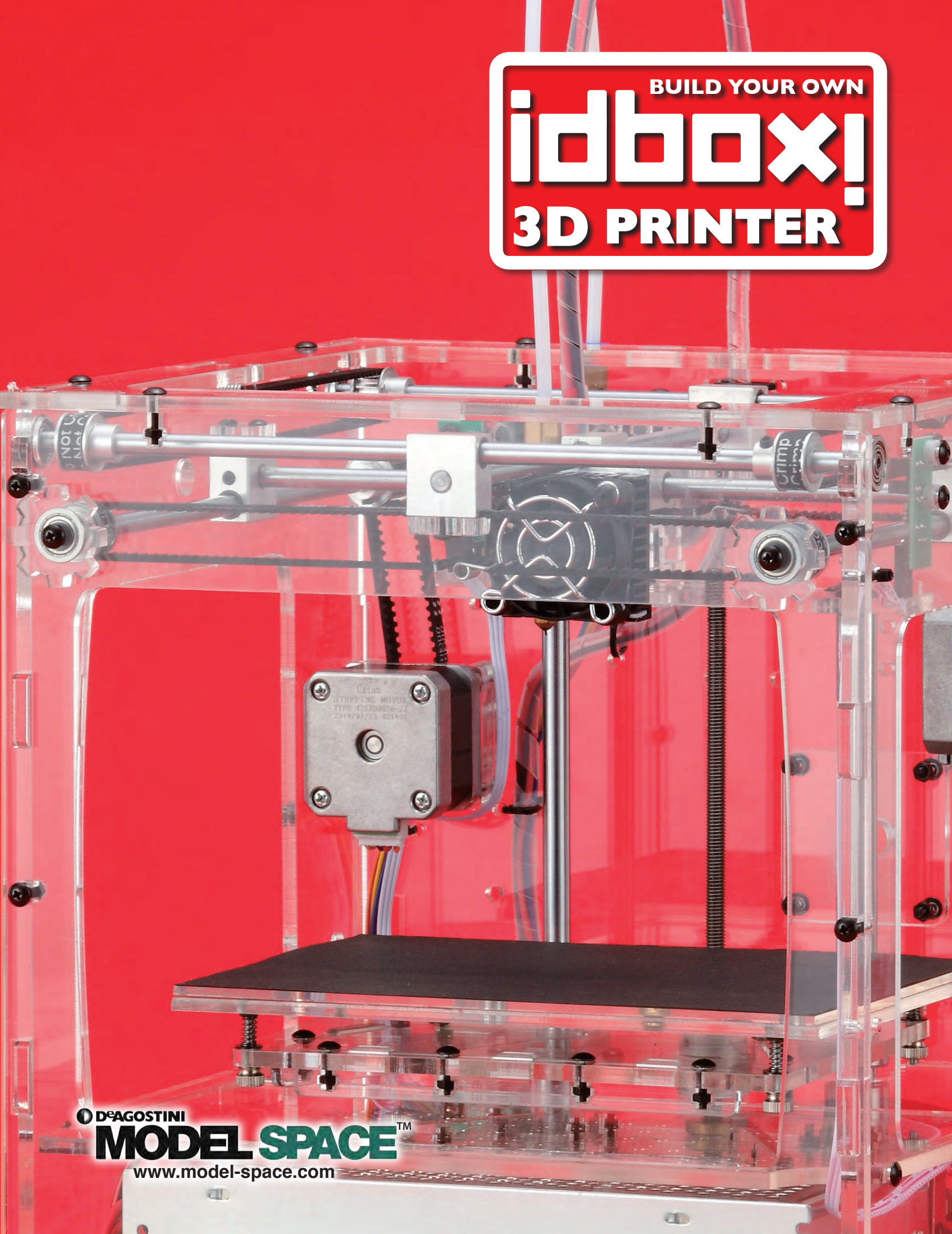
3D PRINTER



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