SOLIDPRINT

REINVENT MANUFACTURING

OUR FDM 3D PRINTING CHEAT SHEET

A GUIDE TO ACHIEVE RELIABLE PRINTING

STEP 1 | Your 3D Printer

1

LEVEL THE BED/ NOZZLE Z-OFFSET

A single sheet of paper is 0.1mm/100 microns thick, we shall use this as a feeler gauge. Slide the paper between the nozzle and bed, you should feel a light resistance. Repeat this process for each corner of the bed and verify in the centre of the bed.

Several of our printers include auto bed levelling, therefore you wont ever have to worry about this process.

2

CLEAN NOZZLE

Three great easy to find tools are, acupuncture needles, brass wires brushes, and any suitable diameter filament. Acupuncture needles are smaller than 0.4mm, which is a standard nozzle size.

Heat up the nozzle, and push this upwards. Brass wire brushes can be used to clean the nozzle while its hot to remove any exterior build up. Lastly a suitable diameter filament can be pushed down through the heater block and into the nozzle. Either by applying continual pressure until filament is extruded through the nozzle.

3

BEARINGS & BELTS

Check bearings and belts periodically to ensure that they have the correct tension.

Most printers have tensioners built in, and the manufacturer will have supporting documentation for the correct tension. But how do you correspond tensions with manufacturers guidelines?
Through decibels! Give the belts a “twang” and record it on a handy decibel tunng app on your phone, and ensure that this fits the levels required.

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4 FIRST LAYER

Don't print your first layer too close to the bed, you could cause the extruder to skip and the nozzle may block as the filament can't extrude through the nozzle.

Likewise, don't print too far from the bed, or the first layer won't adhere to the bed and the print will come off.

5 BOWDEN TUBE

Ensure your Bowden tube is clean as it can quickly harbour dust and filament particles. Any debris inside the Bowden tube will cause issues, specifically with under extrusion as the printer cannot pull through the same amount of material to print with when there is resistance.

6 BUIILD PLATFORM SURFACE

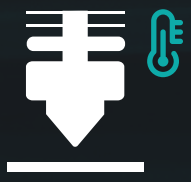
Ensuring the surface that is being printed on is clean will make a huge difference to your printing success. Ensure the surface is cleaned with water, or IPA wipes for greater effect.

Don't touch the bed with your fingers as you will leave grease marks. Another great trick is to apply PVA glue from a glue stick to assist adhesion.

7 CALIBRATE EXTRUDER

With the majority of printers the extruders will be calibrated from factory, however some more basic models may suffer issues. This will ensure that the motor is applying the correct amount of movement to pull through the filament to be printed with.

Default values can be obtained from the manufacturer and applied to the software driving the printer if needs be. However, this is usually not the first step to check in the process of printer maintenance.



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8

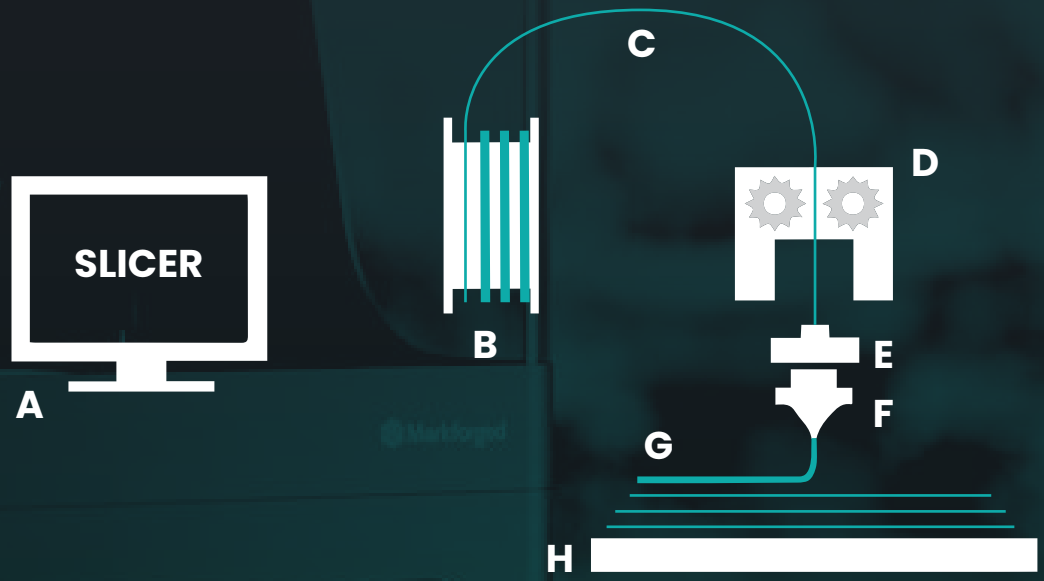
FILAMENT PATH

You can check the filament path is clear by manually pushing filament through when the nozzle is hot (will require extruders to be disabled). If you can easily push the filament in and it comes out of the nozzle as a continuous flow then your printers filament path is clear. If the plastic comes out of the nozzle in a rough, interrupted stream then we need to check for blockages.

Use the image below to check each step of the printing process, and tick off the areas that are clean and free for filament to pass through till you find the issue area.

GOOD

PARTIALLY BLOCKED NOZZLE



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TEMPERATURE CONTROL

If you printer is having trouble keep its temperature stable or suffering from excessive temperature fluctuations then you have may have a faulty part. This could either be the temperature sensor, or perhaps the fans are not creating the correct airflow for the material in question.

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STEP 2 | Environment

1 NO DRAUGHTS

Keep draughts low where required to prevent cooling too fast (e.g. ASA), an enclosed build volume will make a massive difference.

Cooling fans on the printers can be used for some materials with a greater effect than others. (PLA absolutely fine, Nylon absolutely not)

2 TIDY UP

Ensure your environment is clean, tidy and not overly dusty.

3 TEMPERATURE SWINGS

Watch out for wild fluctuations in ambient temperature. Printing in a garage in summer could result in temperature swings of 20°C between day and night, leading to warping and cracking.

A printer enclosure may help with this – ABS nearly always prints better in an enclosure, or a consistently warmer ambient room temperature. See our KORA enclousures for more.

4 VENTILATION

It goes without saying that you should always print in a well-ventilated environment, regardless of the printer or filament being used.

5 DON'T KNOCK IT

Smaller prints getting knocked off the bed during printing?

Use a skirt or brim to aid bed adhesion on tall & narrow or smaller surface prints.

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STEP 3 | File Slicer Settings

1

WATERTIGHT

Watertight refers to the export of the CAD data. If surfaces are not closed up then it will cause print issues.

Using CAD software such as SOLIDWORKS ensures that your exported files will be watertight and printable.

2

CHECK FILES

If a 3D file is suspected to be unusable, you can either import it into CAD and “fix the leaks” to ensure the file is watertight. There are also free stl checkers such as Netfabb that quickly re-export the file for you.

3

FAST LAYERS REQUIRE SPECIAL ATTENTION

If any layer takes less than 15 seconds to print. Consider slowing these layers down or increasing cooling (depending on the material).

Insufficient cooling times can lead to deformation, warping, non-adherence and poor print quality on small features.

PRO TIP!

THE FAIL-FASTER HACK

If you have a print with a particularly difficult feature (for example, a long bridge, steep overhang, narrow gap, very fine feature or you’re needing to calculate tolerances) a great solution is to extract that specific area. Using CAD or the tools available in most slicers you can print that smaller piece in the same orientation.

This way you can test it in isolation without spending the time and material of printing the whole model only to find that that part fails. This is particularly useful for fine-tuning print settings because you can iterate far more quickly with smaller models.

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STEP 4 | Filament

1

CLEAN FILAMENT

A dusty environment can lead to dust on your spool, so you'll want to ensure the filament is clean so that it doesn't cause blockages in the filament path.

If you have a dusty environment, or you're printing with an especially small nozzle size, try keeping the filament in a dry box. This also ensures that hygroscopic filaments don't absorb moisture and cause print failures.

2

NOZZLE SIZE

Composite materials print better with wider nozzles due to the chopped particles inside them. Generally, 0.5mm+ nozzle sizes are optimum for composite filaments. The standard nozzle size is 0.4mm, and smaller nozzle sizes are available for printing fine detail parts.

3

HARDENED NOZZLES

Composite materials (other than soft wood/woodfill) will wear down standard nozzles and filament feeder hobbed gears. Use uprated hardened nozzles and hobbed gears when printing with composite filaments, especially glow in the dark (strontium aluminate is extremely abrasive) metal, glass or carbon fibre-filled filaments.

Ensure hobbed feeder gear is kept clean from particle build-up, or it will slip and you'll under-extrude.

4

BUILD PLATE ADHESION

If you're using a filament that's designed to have lower adhesion (e.g. Break-away), it will be easier to print using a raft. The raft will give a wider base to ensure it adheres to the build platform.

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5 QUALITY FILAMENTS

This is more important that most realise. Use good quality filament and you will have far fewer failures.

If you're in doubt, have a look at the SolidPrint3D shop for tried and tested filaments.

6 SNAP TEST

To check if PLA is still fresh, do the snap test: see if a piece of the filament breaks by bending it back on itself. It should fold without snapping. If it snaps, throw it away – it's gone stale.

Usually, PLA should be replaced 6 months after opening, but good quality filament stored under the correct conditions (e.g. airtight bag/drybox, out of direct light) can last much longer.

7 KEEP FILAMENTS DRY

Dry out older filament, or filament exposed to air for long periods, before using.

Most FDM filaments are hygroscopic, meaning they absorb water. Always dry Nylon before use, as this absorbs the most moisture.

8 FIRMER FILAMENTS

If using a 'regular' (non-flexible) extruder to print flexible filament, use the firmest filament you can, around 95A Shore hardness (e.g. TPU), or those with less friction (e.g. Flexible PLA).

These will be much easier to print with.

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DON'T LEAVE IT TOO HOT

When using soluble support filaments like PVA, if the filament will be waiting in the nozzle for extended periods of time, bring the extruder temperature down by around 30°C while it's on standby.

Hot molten PVA left in the nozzle at printing temperature for long periods of time can lead to blockages.

10

STORAGE

Filament should be stored in a cool, dark place when not in use, ideally in a resealable bag or drybox. UV light, moisture and warm temperatures will degrade your filament over time.

Keep a desiccant in the bag to keep moisture at bay, or keep a chemical dehumidifier nearby.

11

SLOW SPEEDS FOR BETTER RESULTS

Always print flexible materials at a slower speed.

As a rule of thumb, try at about half the speed you would print standard materials, such as PLA or ABS.

12

DON'T LET IT TANGLE

When unspooling and loading filaments, always keep hold of the end so there's no slack and it cannot unravel, even just a small amount. Loosened rings of filament can expand around your spool and fall over the more tightly-wound filament, causing it to lock up during printing.

Similarly, ensure your spool holder is not too loose or allowing excess slack when printing, as this will cause the same issue.

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