

Printing Preparation Steps:

1. Prepare or download a CAD file and save it in **STL** file format.
2. Open the **STL** file with **Cura** or a similar modeling program.
3. Arrange the part orientation to facilitate easy printing with minimal supporting material.
4. Adjust the following settings, depending on application:
 - a. **Print infill** - The amount of fill (in %) that the part will have. This determines the structural rigidity and weight of the finished part, as well as the time required to print. **20%** is a good print infill for light prototype parts.
 - b. **Layer height** - The amount of filament extruded per layer. Mostly, this will remain at **0.1mm**.
 - c. **Print speed** - The speed at which the filament is extruded. Lower speeds yield higher quality prints, higher speeds yield quicker prints. **50mm/s** is a good average speed.
 - d. **Supporting material** - The type and location of supporting material for the print. In general, **Everywhere** works well, but might require post-process sanding to remove the marks from the supporting material.
 - e. **Platform adhesion type** - The method by which the print will be adhered to the printing surface. In general, using **Brim** or **Raft** decreases part warping. **Raft** is stronger, but leaves marks on the bottom of the print.
5. **Save** the part to the **Ultimaker** SD card and load it into the **Ultimaker 2**.

PLA Printing Steps:

1. Turn on the **Ultimaker 2** and select **Print** from the home menu.
2. Choose the part you wish to print from the list. The name of the part will be the name you gave it in **Cura/SolidWorks**.
3. As the printing nozzle and build platform are heating up for the print, roll a light layer of **glue** onto the build platform at the location of the print. This helps the print adhere to the surface and helps prevent warping.
4. It is advised to watch the first few layers print to catch any errors early.

ABS Printing Steps:

1. To prepare for printing **ABS**, a **solution** must be made by dissolving ABS plastic in 100% Acetone for a few hours in a covered container (be cautious of breathing the fumes).
2. Once dissolved, lightly **apply** the solution to the build platform and allow the acetone to dry and evaporate. This leaves a thin layer of ABS for the print to adhere to, which greatly helps prevent warping.

3. Turn on the **Ultimaker 2** and select **Print** from the home menu.
4. Choose the part you wish to print from the list. The name of the part will be the name you gave it in **Cura/SolidWorks**.
5. As the build platform heats up, select the **Tune** option, then **Build Plate Temperature**. Adjust this temperature to **110°C**.

Loading Filament:

After following these steps, the filament will reverse through the tube until it has cleared the motor. The new spool can be added such that the filament points away from the motor. The filament will then bend around the guide in the lower corner of the machine and feed directly into the motor through the port at the bottom of the motor casing. **If the machine fails any of these steps, stop the process immediately and consult the troubleshooting guide before continuing.**

1. Turn on the **Ultimaker 2** and select **Material** from the home menu.
2. Select **Change** and progress through the prompts **only if the previous step has been successfully completed**.

Maintenance:

Occasionally, the extruder nozzle will need to be cleared of debris. These steps will clear any blockage and prevent underextrusion. (Detailed instructions at: <https://ultimaker.com/en/support/view/149-atomic-method>)

1. **Remove** the filament (first step of changing the filament).
2. After the filament has been removed, **slide** the blue clip out from the extruder assembly (located where the Bowden tube enters the extruder).
3. **Press down** on the white coupler and **pull** the Bowden tube out of the extruder assembly.
4. **Heat** the printer head by choosing the following options: **Maintenance > Advanced > Heatup nozzle > 260°C**.
5. **Insert** a spare piece of filament which is a different color from the last filament used. **Manually push** the filament through the nozzle until the new filament color comes out of the nozzle.
6. **Lower** the nozzle temperature to 90°C (PLA) or 110°C (ABS).
7. **Pull** the filament out with a quick, firm pull.
8. **Check** the color and shape of the removed filament. The goal is to have a clean, cone-shaped tip.
9. **Repeat** this process until the filament comes out without residue.
10. **Reassemble** the Bowden tube and **replace** the blue clip under the white coupler.

Troubleshooting:

It is important to identify faults in the process so that future prints may be of higher quality. Many of the variables involved in 3D printing are not absolute and must be tuned to the machine. The **Ultimaker forums** are a great resource for troubleshooting problems with printing. Here are a few tips:

- If the print head does not extrude material and there is a **clicking** sound, **stop** the process immediately. There is likely a **blockage** which is creating resistance and causing the motor to slip. The **Atomic method** (see **Maintenance**) of cleaning should be followed, and the filament will likely need to be changed to remove the grinded parts of the material. (See **Grinding of Filament**)
- If the part looks like it is missing parts of the surface (i.e. holes), this is likely an **underextrusion** problem and can be solved using the Atomic method of cleaning (see **Maintenance**).
- If the part has rough bottom surfaces, it may need supporting material.
- **Warping** is common for ABS plastic. Depending on the part, the print nozzle temperature, print speed, or material flow rate may need to be tuned.

Grinding of Filament:

Occasionally, the motor grinds against the filament until the point where the motor can no longer grip the filament to advance or retract it. This could be caused by incorrect pressure settings or excessive motor slipping due to resistance at the print nozzle.

1. Attempt to remove the filament as normal, though it may not work since the motor cannot grip the material.
2. If this fails, repeat the process while pulling on the filament from the back. Only pull hard enough that the motor can get a grip on the filament that has not been ground.
3. Proceed with cleaning the print nozzle using the Atomic method to remove the blockage.
4. If this does not solve the problem, try adjusting the pressure using a hex key on the motor case on the back wall of the machine.