GUIDE

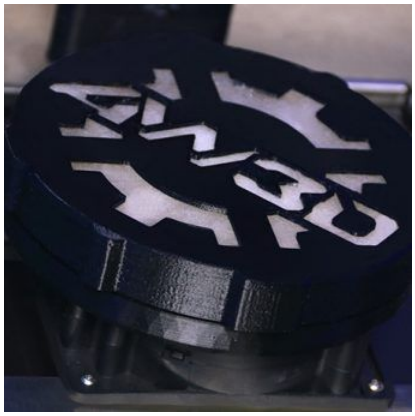
6 Things You Should Know About 3D Printing Large ABS Parts

AIRWOLF 3D

No. 1 Enclosed Build Environment

Heat Containment

Containing heat is absolutely mandatory because ABS, more so than PLA for example, tends to contract at high rates when it cools. This thermal contraction phenomena can cause layers to delaminate and ruin the quality of the printed part. Enclosing the build environment tends to keep more of the heat inside the chamber to counteract, or at least slow down, the process of thermal contraction.



Odor containment

An enclosed build environment also tends to contain a large portion of the ABS odor. In addition to containing odor, a HEPA and Carbon air filtration system will also help contain emissions.

No. 2 Powerful Heated Build Plate

Heated Build Plate

A powerful heated build plate is also critical printing large ABS parts. We find that when printing larger than approximately 10 inches in diameter, the heated build surface must be at least 135C. For extra large prints, we frequently set the temperature to 150C to prevent warping at the base of the part. During the printing process, this heat also tends to increase the chamber temperature of the printer, to further manage thermal contraction.

Power Supply

Getting the build plate to over 120C can be very power intensive and for this a large power supply must be used. For example,for large format 3D printers with a 12” bed, at least 1000W will likely be necessary to adequately manage the heated bed.

No. 3 Adding Heat To The Chamber

Chamber Heaters

Adding heat to the chamber is crucial for large ABS parts. For heating large build volumes, a heated bed is a good start, but simply not enough when dealing with large prints. When printing ABS parts more than approximately 8 inches in height, chamber temp tends to plays a critical role in part quality. In particular, keeping the chamber at 50C or higher can prevent layer delamination that can ruin the appearance and quality of your part.

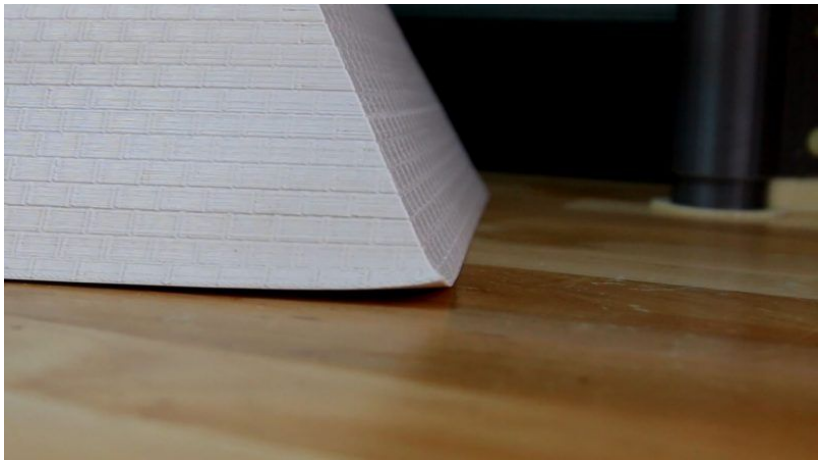
Temperature Control

Temperature-controlled chamber heaters can precisely control the chamber temperature. When used in connection with a heated bed, the chamber heaters can also quickly warm the chamber to reduce standby time. Chamber heaters are also beneficial because they can be adjusted to work with a wide range of materials. This feature can be especially important in large scale 3D printers. For instance, with polycarbonate and nylon we raise the chamber temperature hotter than with ABS.

No. 4 Surface Adhesion

Strongly adhere the part to the build plate

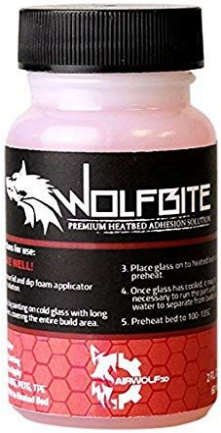
Appropriate surface adhesion goes for nearly any part you will make. It is a foundational requirement of a large ABS part. As we started Airwolf by using 3D printers to print more 3D printers, we found the need for a reliable surface adhesion to avoid the warping that can destroy part quality. Even with high chamber temperatures, large ABS parts will warp without correct surface adhesion.



Example of Warped Part Without Proper Adhesion

6 THINGS YOU SHOULD KNOW ABOUT 3D PRINTING LARGE ABS PARTS

We invented Wolfbite for ABS, and variants of Wolfbite for nearly every other material, to reliably couple the print to the build surface. Without appropriate surface adhesion it is nearly impossible to make parts larger than a couple inches in diameter with ABS. Wolfbite in particular adheres the 3D print to a smooth and planar glass printing surface when hot and after the print is finished and the build plate cools, the part releases from the build platform. The best practice is to apply Wolfbite to a cool glass surface and then apply heat with the heated bed.

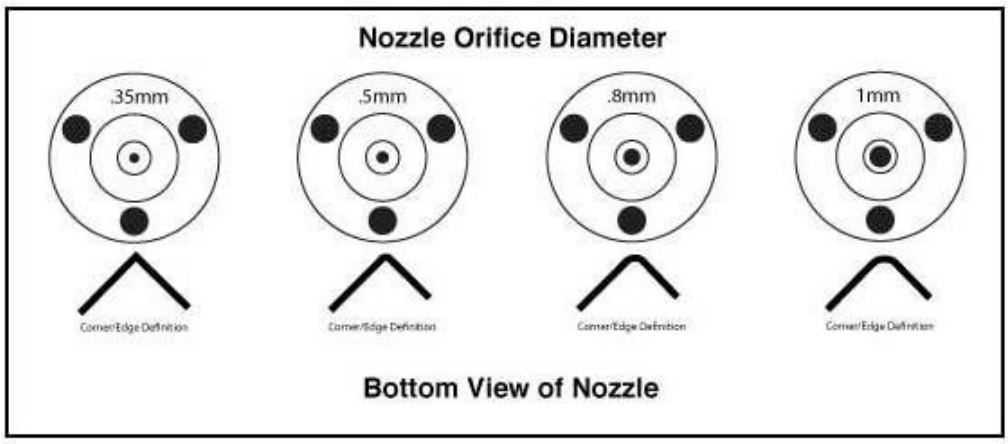


Example of Perfect Bed Adhesion of Large ABS Part (with Wolfbite)

No. 5 Large Extrusion Nozzles

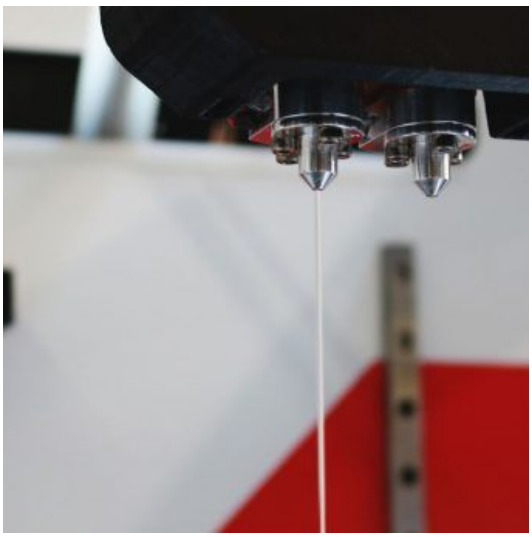
Nozzle diameter

Printing large parts takes time and can use an extraordinary amount of filament, sometimes more than 5 lbs of ABS for large prints. As print time is directly proportional to material flow through the nozzle, the more material we flow, the faster we can finish the print. The most reliable way is not to increase the gantry speed, but rather to increase flow rate. Therefore, our recommendation is to speed up the process by using large extrusion nozzles.



Math

Nozzle orifice area increases to the square of nozzle radius.



Area = π*Radius*Radius.

.4mm nozzle Area = 3.142*.4*.4 = **.50 mm^2**

1.0mm nozzle Area = 3.142*1.0*1.0 = **3.14 mm^2**

As shown above, our 1.0mm diameter nozzle has more than **6 times** the extrudable area of a .4mm nozzle. Increasing print speed by a factor of 6 is a major advantage on long, multi-day prints. Another benefit of larger nozzles is more reliable extrusion (because of decreased filament back pressure) and stronger parts. When we make parts this large, we want them strong. As wall thickness increases, the part is built stronger and less prone to cracking. We tend to over extrude the walls to 1.2mm to provide even more strength.

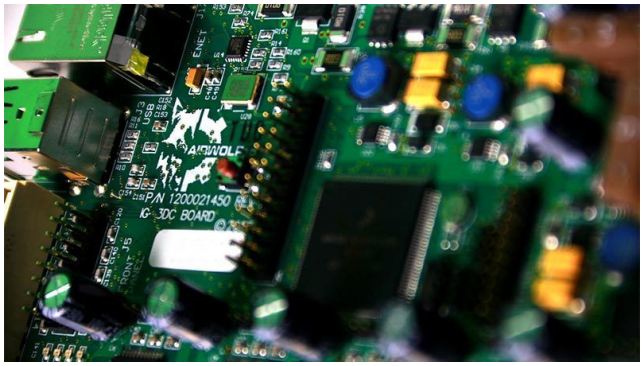
No. 6 Backup your print

Backup basics

Large objects that consume copious amounts of filament at high flow rates, and for extended periods of time, may fail. There may be a power outage, filament may run out, or filament may be compromised. For this, you should use a system with the ability to backup your print to save your work (and your filament!)

Software/Hardware Backup

We combat this problem without a battery backup, by using our GENESIS microcontroller and Touch Screen software. If you lose power or filament, you can pick up where you left off by following the instructions on the Touch Screen to restore the print.



For example, when the printer is started after a power interruption, you will be prompted to resume your print at the line number that was last printed. Otherwise, if the printer continued on, but just ran out of filament or jammed, you will be prompted to lower the nozzle to the surface of the part. The printer will resume printing on top of the last successful layer.

Without software, battery-based hardware backup systems are probably not feasible if your printer draws enough current to correctly print large ABS parts. Specifically, the amperage draw from your printer will likely exceed most reasonably sized battery backup systems.

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