



Nylon 12

SOFTWARE / PRODUCT / FINISHING

Overview

Nylon 12 is a semi-crystalline, FDM® thermoplastic. As with other semi-crystalline materials used in traditional manufacturing processes, there are special considerations that should be implemented to ensure an optimal part is obtained. The information in this document illustrates the following considerations:

- Tip Selection
- Build Modes
- Porosity
- Sacrificial Tower Features
- Build Sheets
- Support Removal
- Annealing

1. Printing Recommendations And Tips

1.1. Tip selection

The smaller the slice height, the better the part aesthetics and surface finish. Larger slice heights can improve strength and toughness by up to 10% and build speed by 30% or more.

- Available model tip sizes / slice heights:
 - T20: 0.330 mm / 0.013 in
 - T16: 0.254 mm / 0.010 in
 - T12: 0.178 mm / 0.007 in



Figure 1: Model and support tips.

- Support tip size:
 - T12 SR-100™ (same as PC support tip)
 - SR-110™ (Nylon 12 support material) uses the same tip as SR-100. Once the tip has been used for SR-110, it can only be used for SR-110.

1.2. Build modes

The build modes adjust the oven temperature to control the crystallization rate and avoid melting or warping problems for various wall thicknesses (Figure 2 and Table 1).

NOTE

Users should select the build mode based on the thickest portion of the part geometry.

Build Mode	Dimension (thinnest wall) mm(in)	Oven Temp (°C/°F)
Thin Wall	<1.27 (0.05)	80/176
Normal	1.28(0.05) to 12.7(0.5)	100/212
Brick	>12.71(0.5)	120/248

Table 1: Build mode parameters.

1.3. Porosity

There are three interior tool path variables to consider that can change the porosity of a part (Figure 3):

- Multiple contours:
 - Multiple contours can be used to hide raster turnarounds and enhance aesthetics.
- Contour to raster air gap:
 - Decrease the **Contour to raster air gap** to create a stronger part.
 - Adjust the **Contour to raster air gap** +0.025 mm (+0.001 in) to create a more aesthetically pleasing part.
- Raster to raster air gap:
 - The **Raster to raster air gap** default creates a slight overfill of the part and increases its strength.
 - Use a positive air gap +0.025 mm (+0.001 in) to +0.076 mm (+0.003 in) to improve aesthetics.

1.4. Sacrificial tower features

Nylon 12 is a sticky material. A sacrificial tower feature has been added to the Control Center in the Insight™ software to help increase part quality (Figure 4).

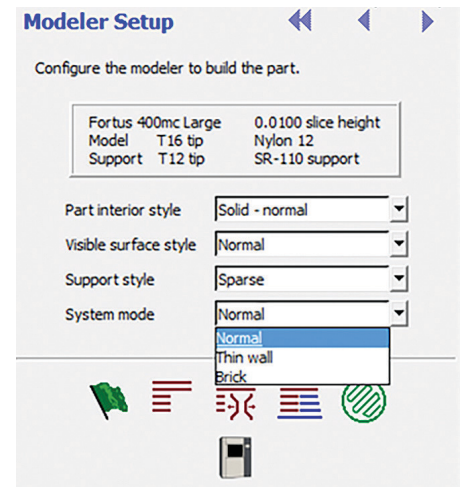


Figure 2: Build mode selection.

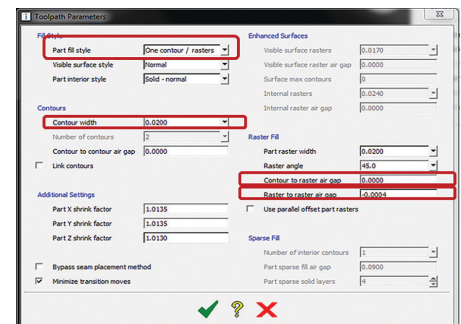


Figure 3: Porosity variables.

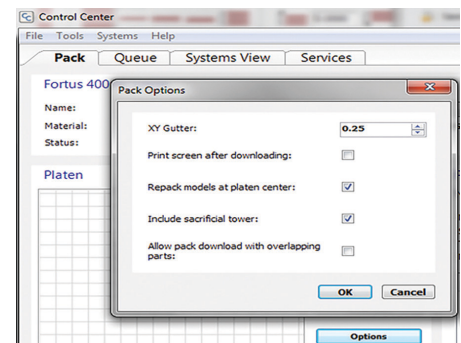


Figure 4: Adding sacrificial tower.

- When packing a job in Control Center, select the Options button and check the Include sacrificial tower box in the Pack Options pop-up window.

1.5. Build sheets

Nylon 12 build sheets are moisture sensitive (hygroscopic). Dry build sheets draw down on the vacuum platen faster (Figure 5).

- Keep one build sheet inside the build envelope below the tray at all times. It will be used for the next build.
- Open the sheet package from one end only. Fold the package closed when done to ensure it is sealed. This will prevent moisture absorption from the surrounding environment.

1.6. Support removal

Nylon 12 parts will be pliable at oven temperature. To maintain dimensional accuracy, either cool the oven to 75° C (167° F) before removing the part, or remove it by handling the build sheet only. Do not touch the part until its temperature is less than 50° C (122° F).

- Parts must be submerged in water or in the WaterWorks™ tank for a minimum of four hours after building. This will allow the part to:
 - Maximize its mechanical properties
 - Maximize its dimensional accuracy
 - Maintain its intended shape
- All support material must be removed from the part otherwise it will make the part brittle.
- Due to the temperature sensitivity of Nylon 12, it is important to set the temperature of the support removal tank to the specified levels (Table 2).
- Immerse parts in lower temperatures to reduce the risk of warping.

NOTE

Failure to submerge parts after printing will potentially cause the part to be brittle.



Figure 5: Build sheet preheating in build envelope.

Build Mode	Dimension (thinnest wall) mm(in)	Support Removal Tank Temp (°C/°F)
Thin Wall	<2.54(0.1)	50/122
Normal	2.55(0.11) to 12.7(0.5)	60 /140
Brick	>12.71(0.51)	70/158

Table 2: Support removal tank temperatures.

1.7. Annealing

Annealing is a post-processing step used to increase the temperature resistance of Nylon 12 parts. It is only recommended when finished parts will receive prolonged exposure to temperatures greater than 50° C (122°F).

- When annealing a part, change the shrink rate factor in the **Toolpath Parameters** window (Figure 6) according to the default shrink factor shown in Table 3.

Slice Height	Orientation	Value
T12	X & Y	1.0065
T16	X & Y	1.0080
T20	X & Y	1.0090
T12	Z	1.0060
T16	Z	1.0060
T20	Z	1.0065

Table 3: Default shrink factors.

- Remove parts from the build sheet and place in a temperature controlled oven (not the Fortus® system) with support material still intact (Table 4).

Build Mode	Dimension (thinnest wall) mm(in)	Annealing Temp (°C/°F)	Annealing Time in Oven (min)
Thin Wall	<2.54(0.1)	130/266	300
Normal	2.55(0.11) to 12.7(0.5)	135/275	180
Brick	>12.71(0.51)	143/290	60

Table 4: Annealing temperatures and time in oven.

- Immerse the part in the WaterWorks solution to remove all support material.

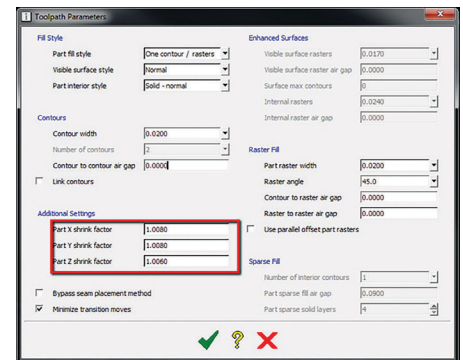


Figure 6: Changing shrink factor.

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