Nylon CF Best Practice Guide

Titan/Vantage/Fortus360mc/Fortus400mc/Fortus900mc

Overview

Nylon CF is a polyamide material that utilizes chopped carbon fiber to increase its overall strength to weight ratio and tensile strength. With Nylon CF, the fibers will be in the direction of extrusion which is in the XY plane, it will be strongest in this plane due to the nature of FDM printing.

The Nylon CF material option will allow Nylon CF to be run on T-Class and Fortus 900mc systems. A hardware upgrade is required to optimize the printer to run this material option with the embedded carbon fiber. The installed hardware can also be used for all other rigid FDM materials. For best results when using this material option, load the custom toolpath parameters (.SBS file) in the Insight software after opening the required STL files.

Special Considerations

- The systems will utilize the Nylon material option to run Nylon CF. Nylon will utilize parameters that are best suited to run the CF option. The Nylon material option will use the correct parameters such as oven temperature, extrusion temperature, etc… and the minor differences between Nylon and Nylon CF will be addressed in the supplied .SBS file for use with the Insight software.

- A tip change wizard should be performed to setup the machine with Nylon CF material at a T16 layer resolution. A T20C tip can be used for the model material, while the machine is setup/calibrated for T16. This allows the tip to have a larger orifice size and minimize the chance of the tip clogging. The support tip remains standard and will be a SR-100 tip (while using SR-110 support material).

- Nylon CF is highly susceptible to moisture contamination. It is required that the material be unloaded and sealed when the machine is not in use.

- If Nylon build trays absorb moisture, they will difficult to draw down via the supplied system vacuum. If necessary, a build tray can be placed under the build platen to be dried prior to the next Nylon build. The build tray must be removed prior to changing the material to a higher temp material to avoid melting the build tray inside the oven.

- Inspect the tip wipe assembly, flicker brushes, and purge ledge after every build to ensure a buildup of material has not occurred.

- When placing the finished parts in a support cleaning station, parts built using Normal mode should be conditioned at 60 degrees Celsius. Parts built in Thin Wall mode should use 50 degrees Celsius.

Machine Procedures/Hardware Considerations

Upon initial Nylon CF installation, a new head assembly will be required. This new head assembly can also be used for all other rigid FDM materials. The head contains mechanical upgrades specifically designed to withstand the abrasive nature of the carbon fiber.

Insight Software Considerations

Loading .SBS Files

Custom .SBS files will be used to run Nylon CF. The .SBS file extension has been created to ensure the material is optimized in the Insight software. The .SBS file extension will utilize material specific parameters to ensure optimized build performance such as support oversized base, adjusted shrink values, adjusted tool path widths, etc…

Step 1:

Copy the provided .SBS files in the following default directory (depending on Insight version):

C:\Program Files\Stratasys\Insight 12.6\train

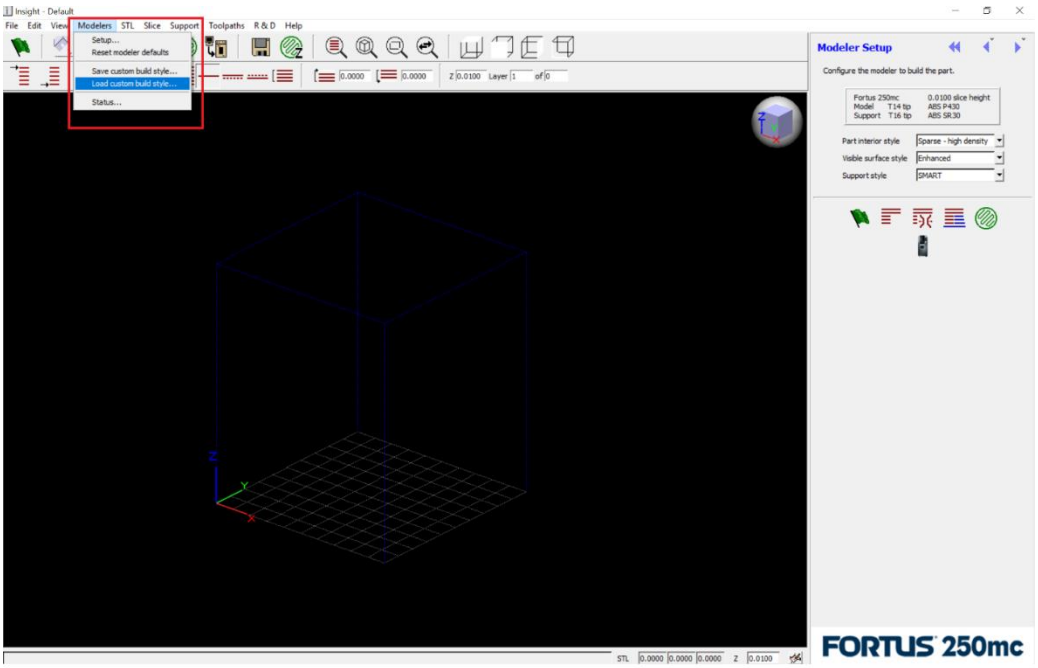
Note the .SBS will have to be copied to the same updated directory if the software is updated or reinstalled.

Step 2:

Open the desired STL file in Insight. The file can be dragged and dropped into the software, or the user can select “File”, and then “Open” and navigate to the correct directory. **The STL must be opened before loading the SBS file. If the SBS is loaded first, and then the STL file opened, the correct material parameters WILL NOT be loaded properly.**

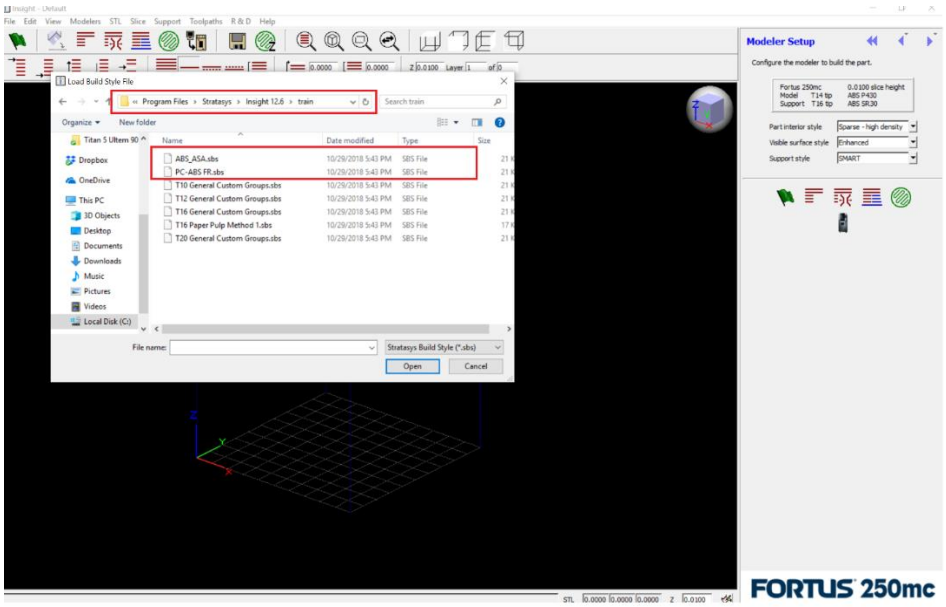
Step3:

Open Insight and select the “Modelers” tool bar. Select “Load Custom Build Style”, as shown below:



Step 4:

Navigate to the location shown in step 1. Select the appropriate .SBS file depending on the material that is being utilized.



The parameters will now be optimized for the specific build material being used. Use caution when changing any tool path parameters, or settings from the default settings used in the .SBS file.

Build Mode Selection

“Normal” is the build mode that should be typically used with Nylon CF. This is the default option and is recommended for most geometries. “Thin Wall” mode can be used for parts that have features or thin walls smaller than 0.508mm or 0.2 inches. If a part shows signs of melting or sagging while printing in normal mode, the build mode should be changed to Thin Wall. This reduces the overall oven temperature and the chances of the part warping during printing.

Build Parameters

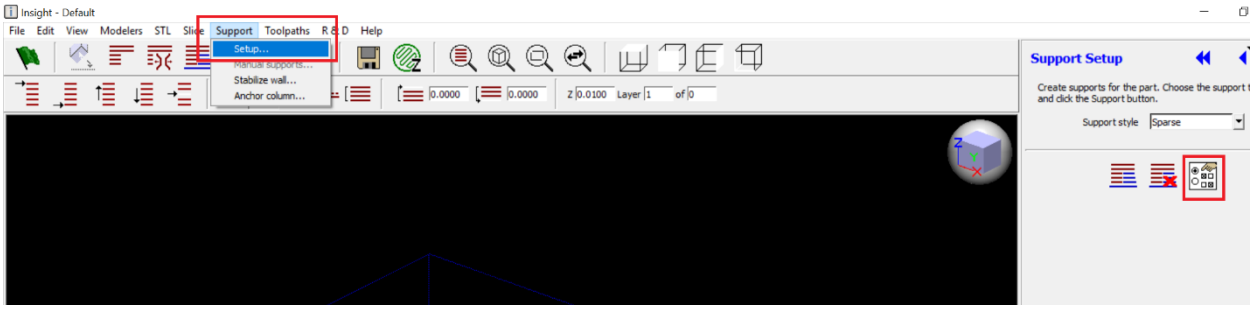
- A minimum toolpath width of 0.020 inch should be utilized. Using a smaller toolpath width can cause part quality issues and decrease accuracy, part quality, etc…

- Solid and sparse build modes can be utilized and the default settings for these parameters do not need to be edited. **Sparse-Double Dense** and **Hexagram interior fills SHOULD NOT be used.**

- Due to the embedded carbon fiber strands in the Nylon material, there will be uneven thermal expansion from model compared to the support material. Using model as support material where possible will help reduce the impact of the two different thermal expansion rates of the materials. See below for instructions showing how to automatically convert the support structures to model structures where possible:

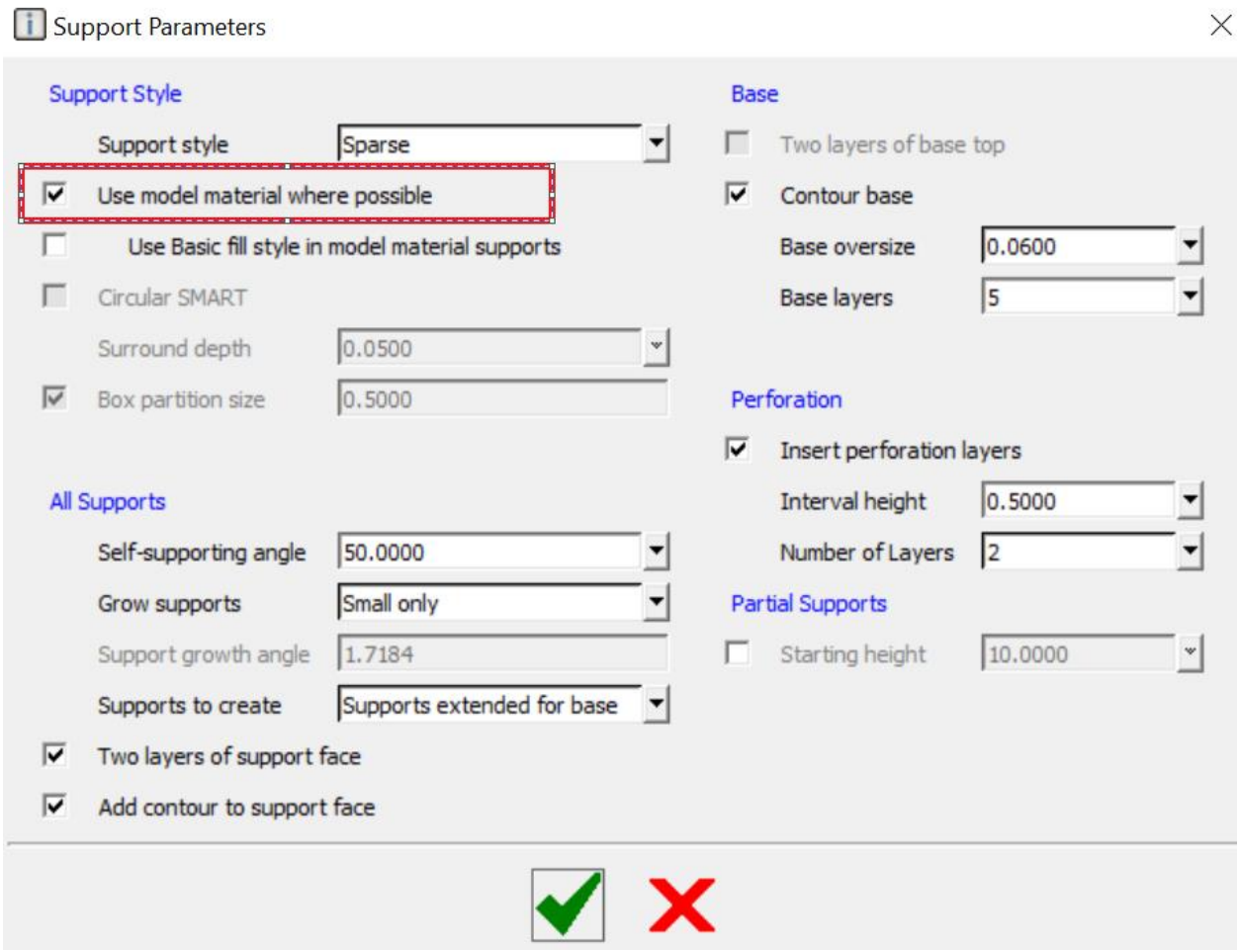
Step 1

Open the Support Parameters menu:



Step 2

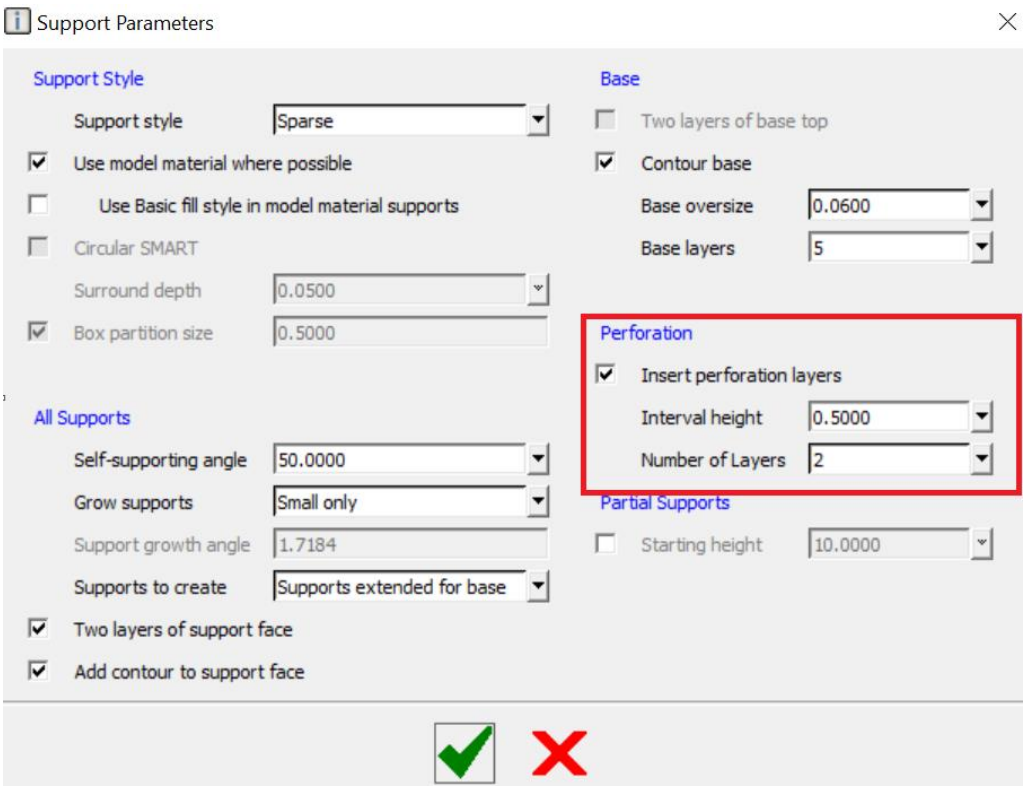
Select the “Use Model Material Where Possible” as shown below.



***Caution must be used when converting model to support for any internal cavities or areas where the support cannot be removed by hand.**

To maximize control over which supports are converted to model material we recommend manually selecting the support towers by using a custom group. Please see the separate document "Custom Groups Support to Model" for full instructions and details.

- When using model as support material, use perforations to facilitate easy removal of the support towers. This option can be found in the "Support Parameters Menu" as previously shown above. Set the number of layers to 2 and the interval height to 0.50 inches as shown below:



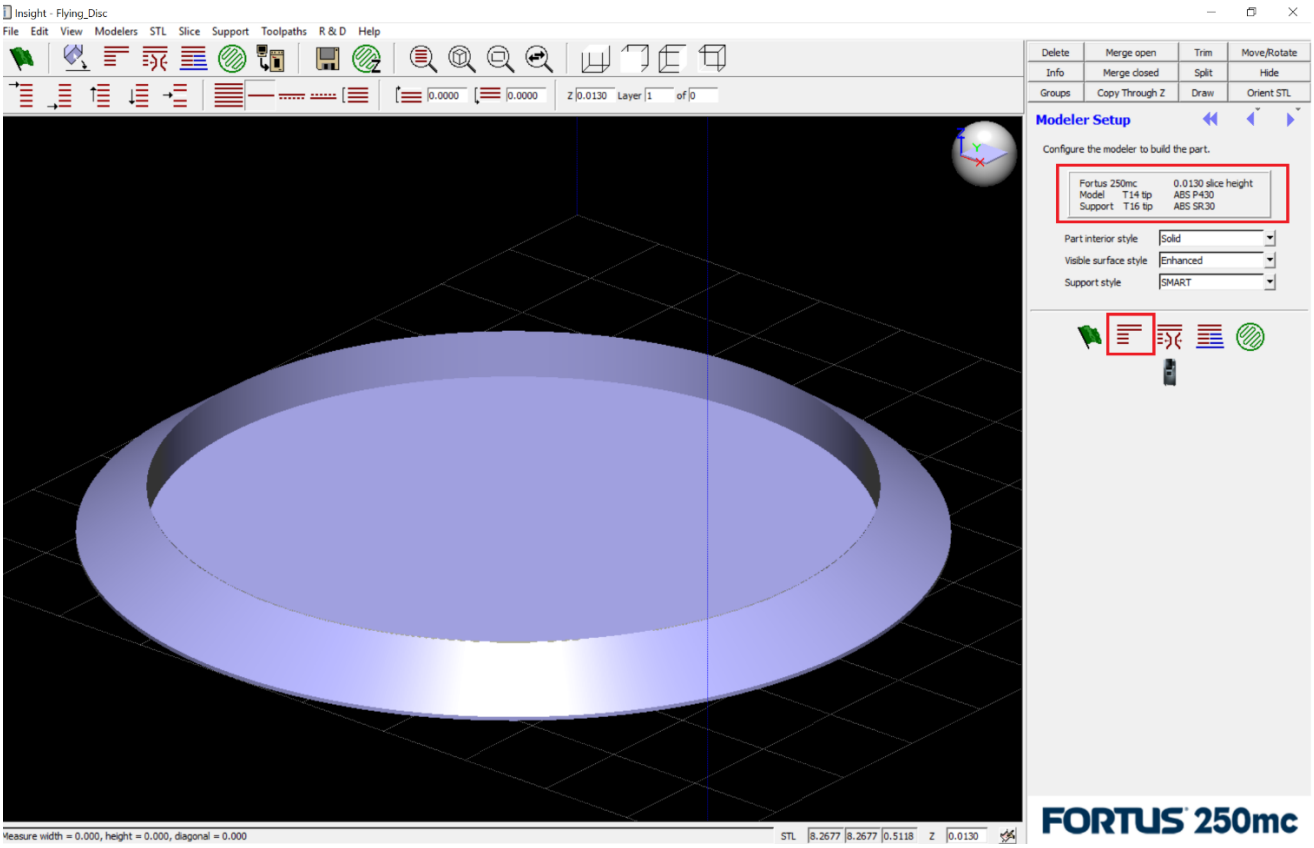
- Sparse or Box support styles are recommended. Box style supports will facilitate easier removal of supports in internal cavities and small areas in the part.

Anchor Columns

- In some cases, part lift or warping may occur on parts with a larger base. This occurs due to a differential of cooling where the edges of the part cool quicker than the internal section and contract. If this occurs, follow the below instructions to place anchor columns on the part, and help secure it to the build tray:

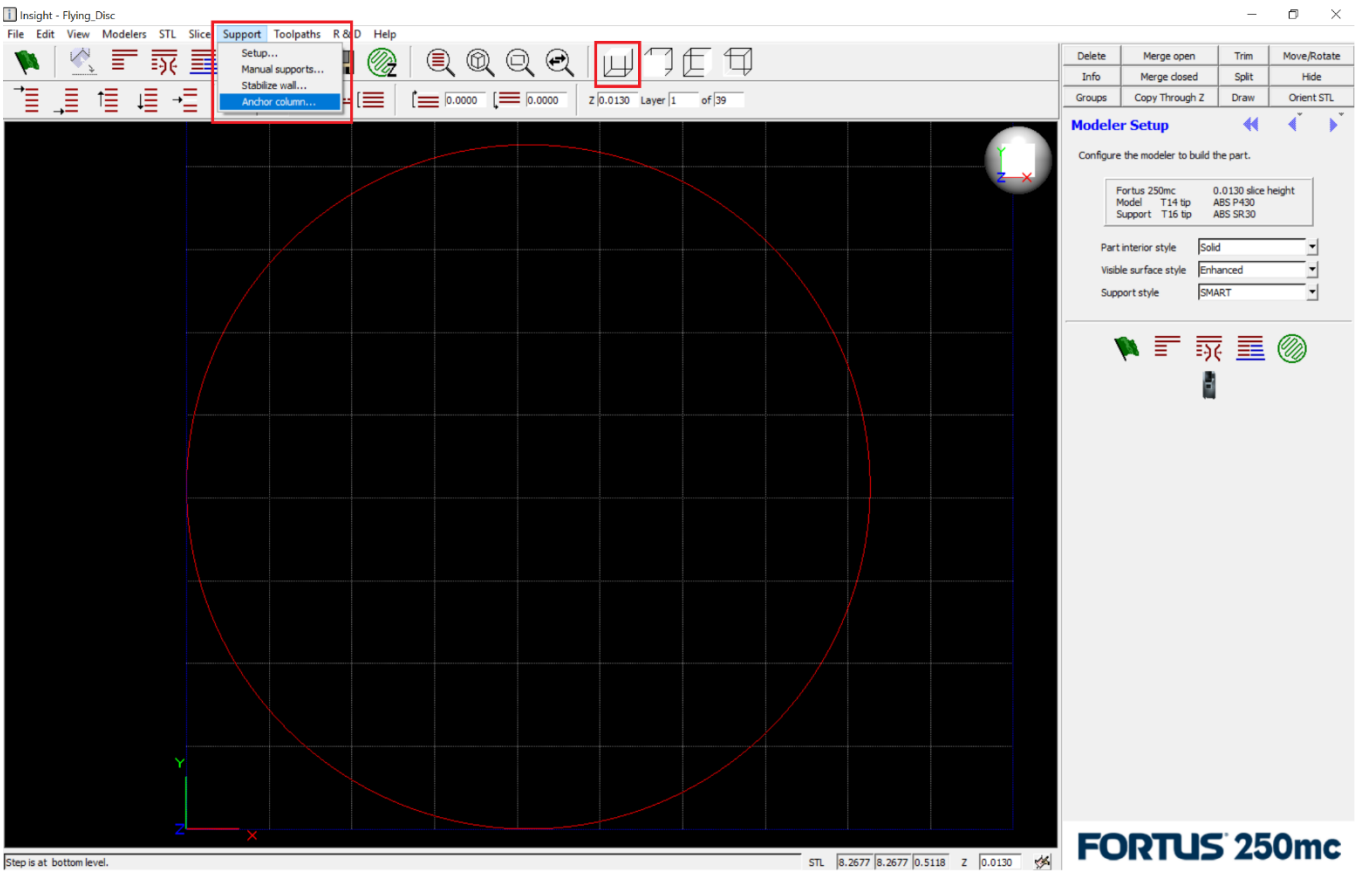
Step 1:

Select the desired orientation in Insight, then select the “Slice” icon to generate the build layers in the Z direction.



Step 2:

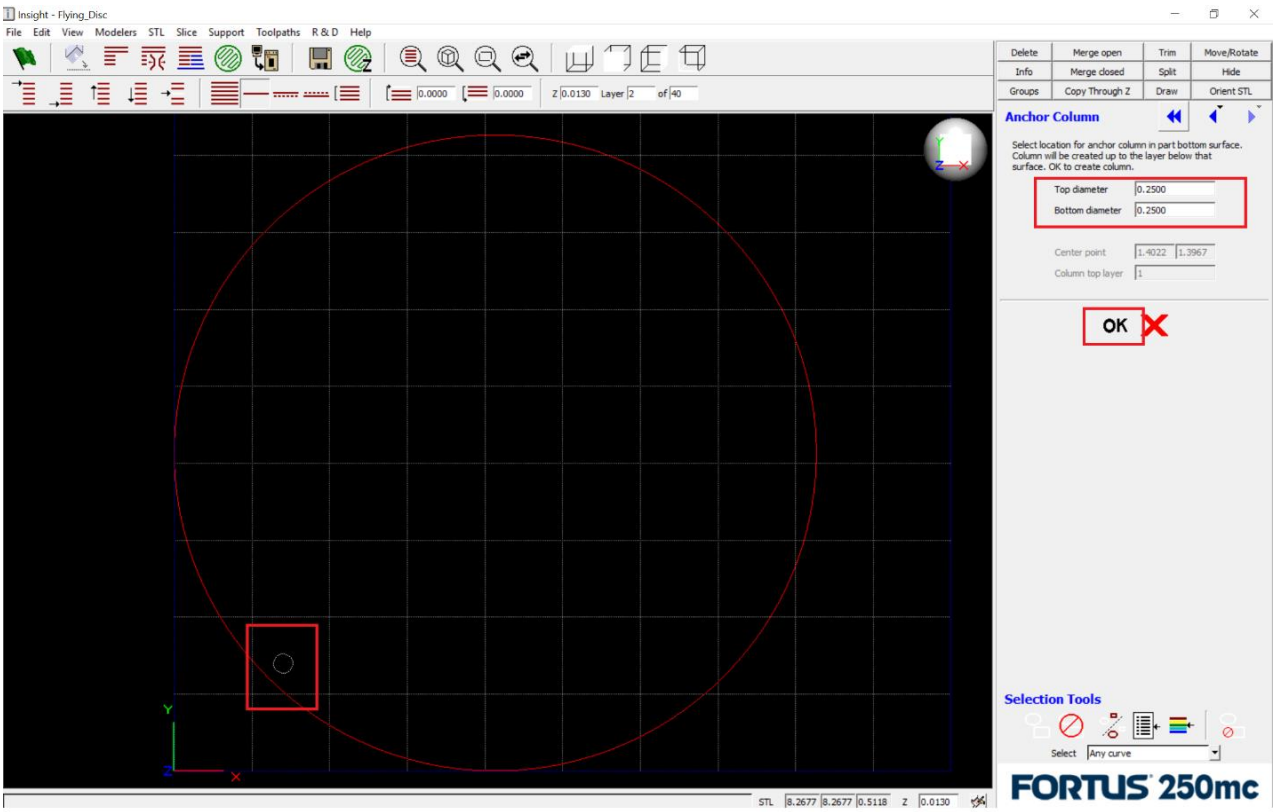
Select the “Top View” icon. Navigate to the layer that will require the anchor columns. This should be the lowest layer with a flat surface and an anchor column will be generated from this surface to the base. Select the “Support” tool bar and the “Anchor Column” option.



Step 3

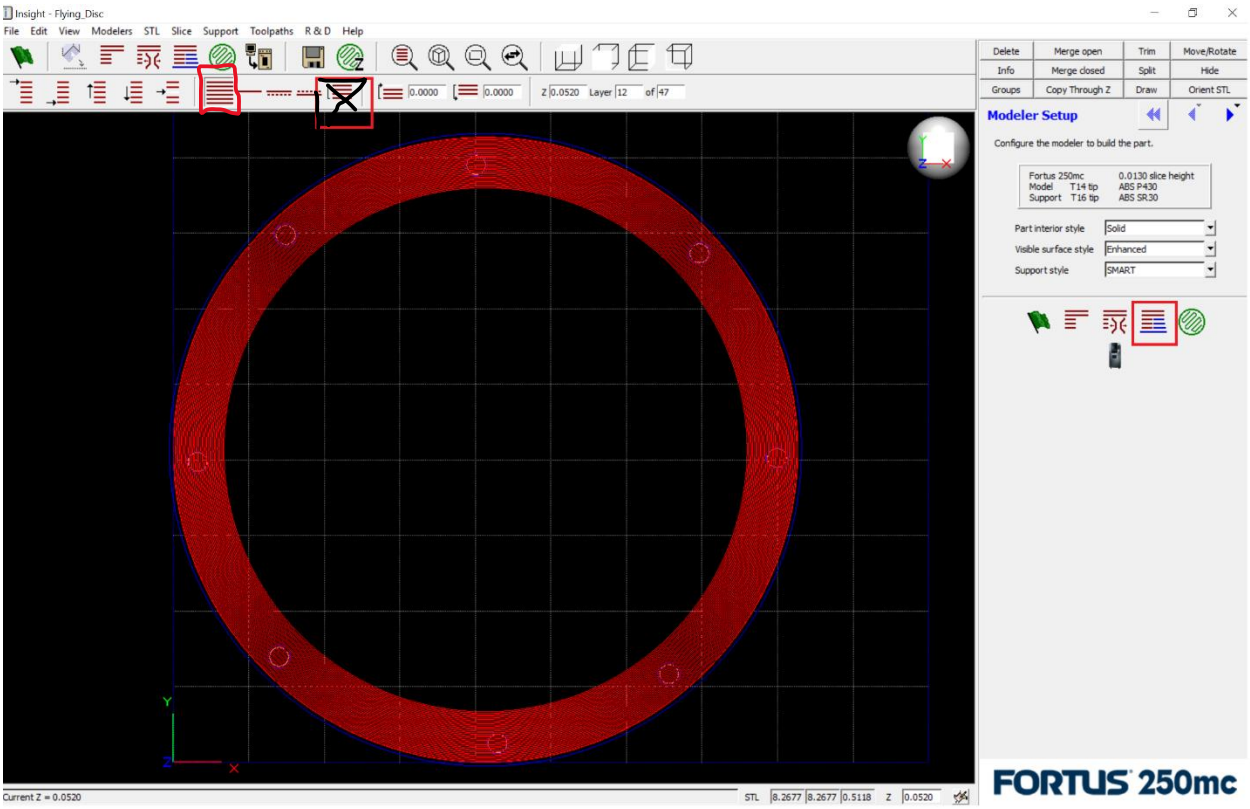
Change the top diameter and bottom diameter values to the desired size (0.25” is recommended for both options for maximum stability of the anchor column. Place the mouse cursor over the desired location, left click with the mouse, and press “OK” after each new selection.

For best results, place anchor columns near the outer edges of the part. Due to a differential in cooling in the build chamber, the outer edges are more likely to cool faster and lift from the base or support structures.



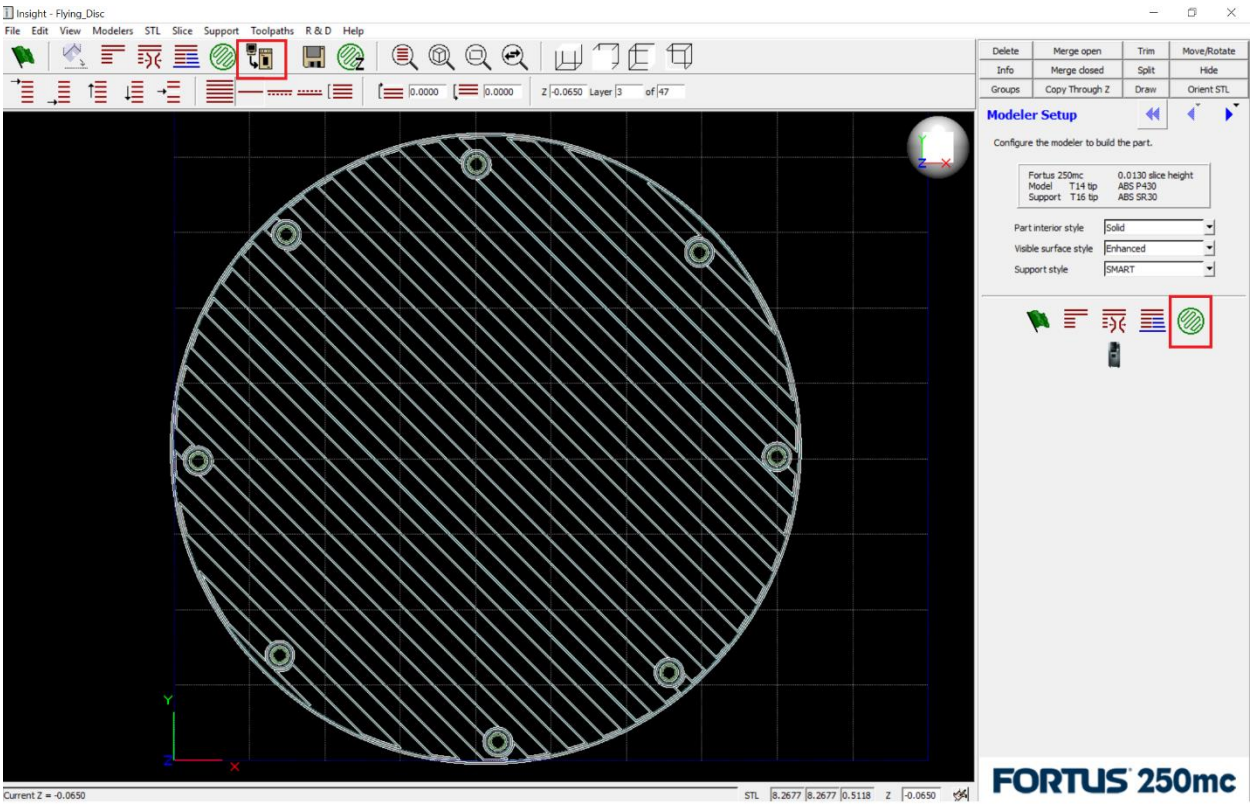
Step 4:

To view the anchor columns, select the “All Layers” icon. Alternatively, support can be generated which will show the new location of the anchor columns.



Step 5:

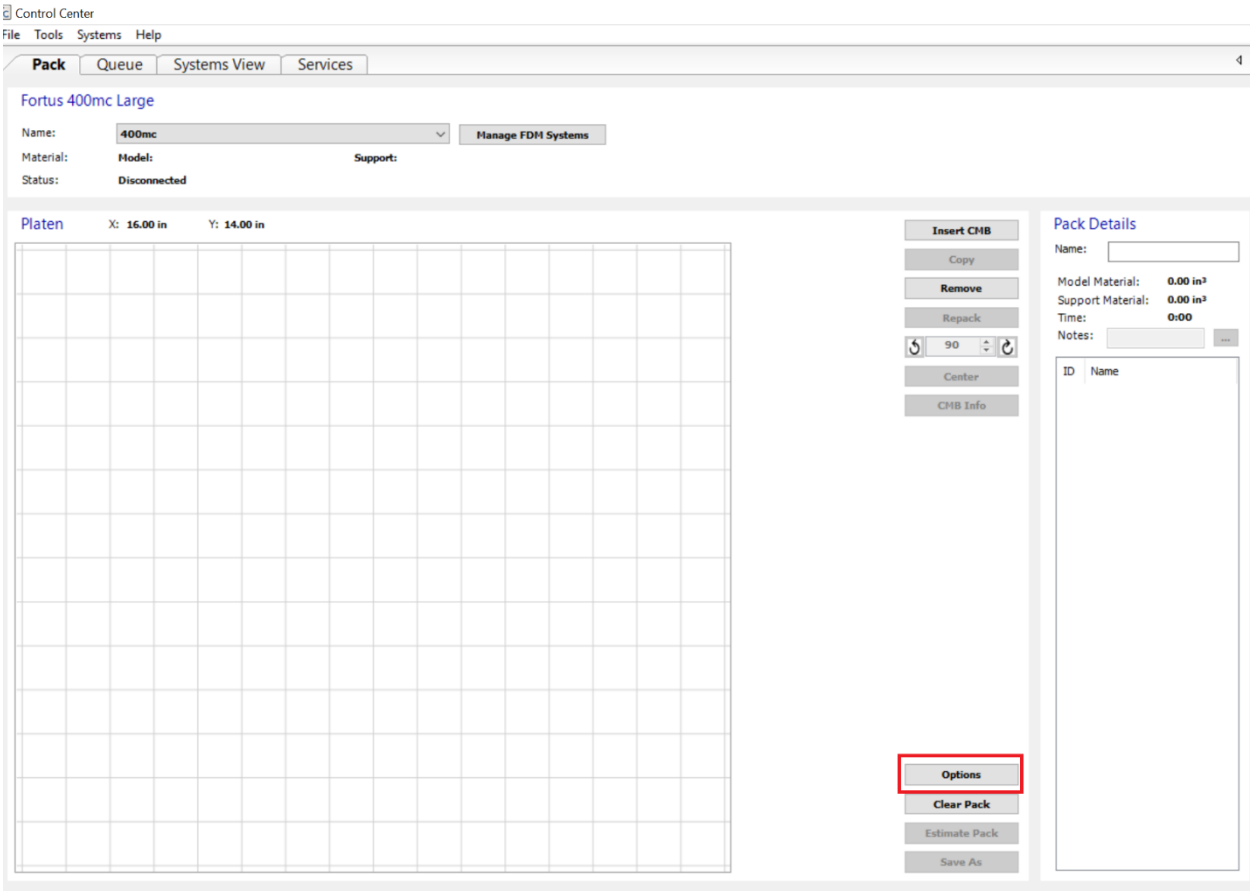
Generate tool paths and verify anchor columns extend from the bottom surface of the part to the base, through the support structures. Review and verify tool paths, and the part can now be sent to Control Center to be built.



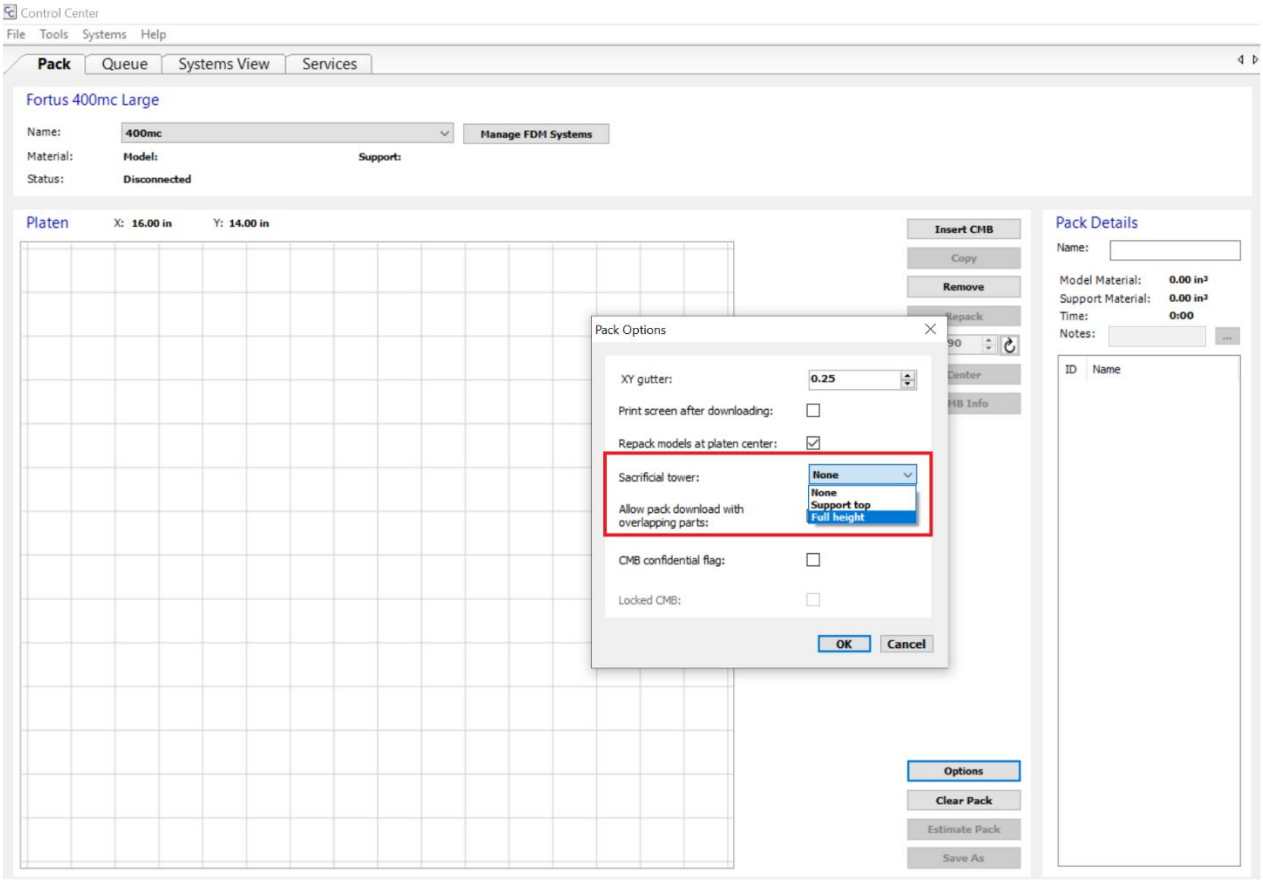
Sacrificial Tower

It is recommended that a sacrificial tower be used for all Nylon CF builds. The sacrificial tower will capture any imperfections at the beginning of the toolpath and improve part quality. To use a sacrificial tower, follow the below instructions:

1) Process the STL files and send to the Control Center software
2) In Control Center select the “Options” icon as shown below:



3) Select “Full Height” under the drop-down list next to “Sacrificial Tower”


Control Center
File Tools Systems Help
Pack Queue Systems View Services
Fortus 400mc Large
Name: 400mc
Manage FDM Systems
Material: Model: Support:
Status: Disconnected
Platen X: 16.00 in Y: 14.00 in
Insert CMB
Copy
Remove
Repack
Center
MB Info
Pack Options
XY gutter: 0.25
Print screen after downloading:
Repack models at platen center:
Sacrificial tower: None
None
Support top
Full height
Allow pack download with overlapping parts:
CMB confidential flag:
Locked CMB:
OK
Cancel
Options
Clear Pack
Estimate Pack
Save As
Pack Details
Name:
Model Material: 0.00 in³
Support Material: 0.00 in³
Time: 0:00
Notes:
ID
Name