

WPI Rapid Prototype Guidelines

--Read entire document before submitting an order--

It will be assumed that you have read these guidelines. If you do not follow the guidelines during submission, you will be responsible for any errors that occur with part processing. Additionally, **be sure to check the announcements on the sharepoint site** before submitting an order.

The Rapid Prototype (RP) machines on WPI campus are meant to be used for parts that cannot be easily made by other on campus methods. Parts that could be easily created in the machine shop, or standard parts that can be easily purchased, are not good candidates for the RP machine.

Be aware that rapid prototyping does not mean instant. When planning for your project, **allow at least 5 business days** for your rapid prototyping needs, especially approaching the end of a term.

When your order is submitted, a quote will be generated and sent to the advisor listed on the order for print approval. You will not be contacted until the parts are ready for pick up, unless there is a problem with your order, or unless you request contact in the description field on the order form. Please respond within 3 days of the pickup notification if there are any problems with your order.

Please provide detailed information in the description field of each Sharepoint submission.

Details regarding the required information for the Description field are included in the document below. If this information is not included with your order, your order will be processed with settings to optimize print time and material use, and you will be responsible for any errors that occur with part processing.

How to use these guidelines:

- 1. Read the specifications of the machine relevant to your project.**
- 2. Confirm that the requirements for your parts fall within the limits of the machine you have selected**
- 3. Read the submission guidelines carefully**
- 4. Save your CAD files as .stl files**
- 5. Submit your quote request via the SharePoint site, including all information requested in these submission guidelines**

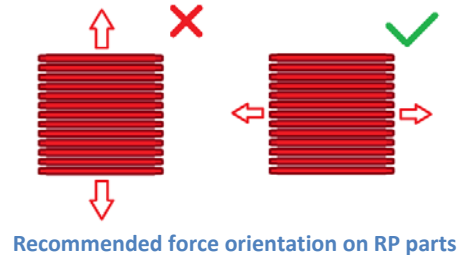
Dimension SST 1200ES Rapid Prototype Machine

The Dimension rapid prototype machine prints with ABS plastic. The ABS plastic is available in several colors: ivory, nectarine (orange), red, black, blue, and yellow. Be aware that color changes will slow the printing of your parts, and incur a \$3 charge. You will be notified if your choice of color is not available.

To estimate the cost of your model, multiply the volume of the part by \$8/cubic inch. The actual cost will depend upon the volume of model and support material required.

Orientation:

Be aware that any circular features in your model can only be perfectly circular if printed axially vertical. Part orientation also affects part strength; parts will be stronger under a tensile load in the x-y plane than along the z-axis.



Part Dimensions:

The minimum recommended wall thickness is 0.060", and features thinner than 0.045" will likely not print. The maximum build dimensions are 10" x 10" x 12(height)", although if the part fills one of those dimensions exactly, the part may not build. The practical limitations are about 1/16" less than 10" in x and y directions, and about 1/2" less than a 12" height.

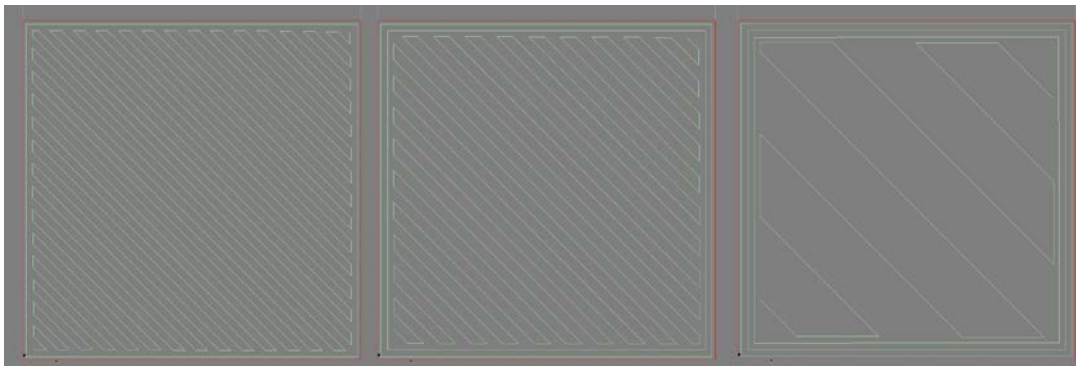
The dimensional accuracy of the Dimension SST has an error range of +/-0.006". The thickness of each layer is 0.0100".

If printing an assembly, be aware that surfaces in contact will not print separately; you must design a clearance gap between all parts that must retain independent movement. The minimum recommended clearance is 0.01".

Part density:

The Dimension RP machine can print parts in three densities: low density, high density, and solid. A change in part density will NOT change the outer surface of the part. The outer three layers of plastic will always be printed as solid, regardless of the density selection made; only the innermost volume of the part will be changed. The machine tool paths of solid, high and low densities are shown below.

Solid is only viable for very small parts (less than 0.5" in two dimensions), that will not print well with high density. High density creates a very tight honeycomb-like interior; this print option is very close to solid. The low density option creates a looser honeycomb-like interior, and will reduce print time and material requirements.

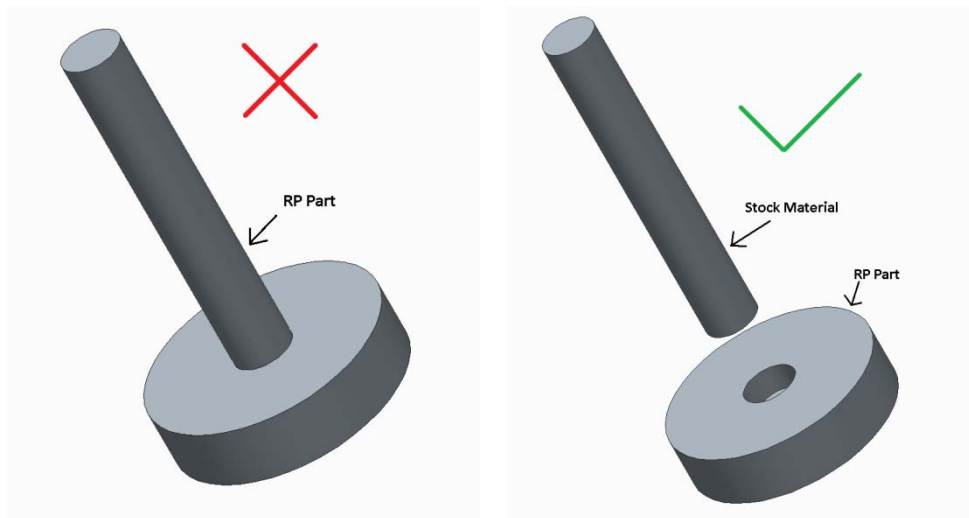


General Recommendations:

Cutting or drilling into parts printed on the Dimension RP machine is not recommended. If you need to use screws to fix your printed part to your assembly, design the part with preexisting screw holes.

In general, it is not recommended to insert a printed part into another printed part. If this cannot be avoided, an allowance of at least 0.01" is recommended. If fit needs to be improved, parts can be very lightly sanded.

It is not recommended to print shafts or pins in your parts; these features will be relatively weak, and unless printed axially vertical, not cylindrical. It is recommended that you find a stock material that is of appropriate size, and use that as the shaft or pin.



Dimension machine submission checklist:

- Does my part fit on the print tray? (check maximum dimensions)
- Do I have any wall thicknesses less than 0.06" (1.5 mm)?
- Do I have any circular features that need to be particularly accurate?
- Does the part need to be stronger in one direction than another?
- Are my parts going to be under significant stresses while in use?
- Do I have an appropriate allowance between dimensions on any parts that will be assembled together after printing?

Objet260 Connex Rapid Prototype machine

Any student submitting an order to the Objet RP machine will likely be required to meet with the machine operator to discuss the order before printing will proceed. After submitting a quote request, you will be contacted to set up a meeting time.

Parts printed with the Objet machine tend to cost approximately 4-5 times more than those printed with the Dimension machine.

Materials:

The Objet RP machine can print with up to 14 different material properties within one part, creating a wide range of material properties. Over 60 material options are available, however not all can be included in one print. Material options are described in "Objet Material Information.pdf", posted on the main page of the RP sharepoint site. Review this additional document before order submission.

Part Dimensions:

The maximum dimensions of the print tray are 10.0" x 9.9" x 7.9", and the horizontal layer thickness ranges from 0.001" to 0.0006". The typical accuracy for the machine is +/-0.0008"-0.0033" for features below 50mm, and up to +/-0.0078" for the full model.

In practice, the minimum wall thickness that will print without deformation or error is 0.015" (0.38 mm). Features this small, however, have a tendency to break in the pressure washer used to clean the parts. If you have very thin features, you can request that the parts are put out for pick up without cleaning in the pressure water. The support material will need to be removed manually after pick up.

Surface Finish:

A glossy finish can only be applied to surfaces that do not require support material. When submitting your order, you must specify which surfaces require glossy finish. If the requested surfaces are not possible, you will be contacted before your order prints. If no glossy surfaces are requested, glossy will not be used.

Glossy can be used to reduce or eliminate the need to clean the parts in the pressure washer. This can be very beneficial for parts with fine features that may break during cleaning. Glossy does, however, cause some rounding of the edges of features.

Shelling:

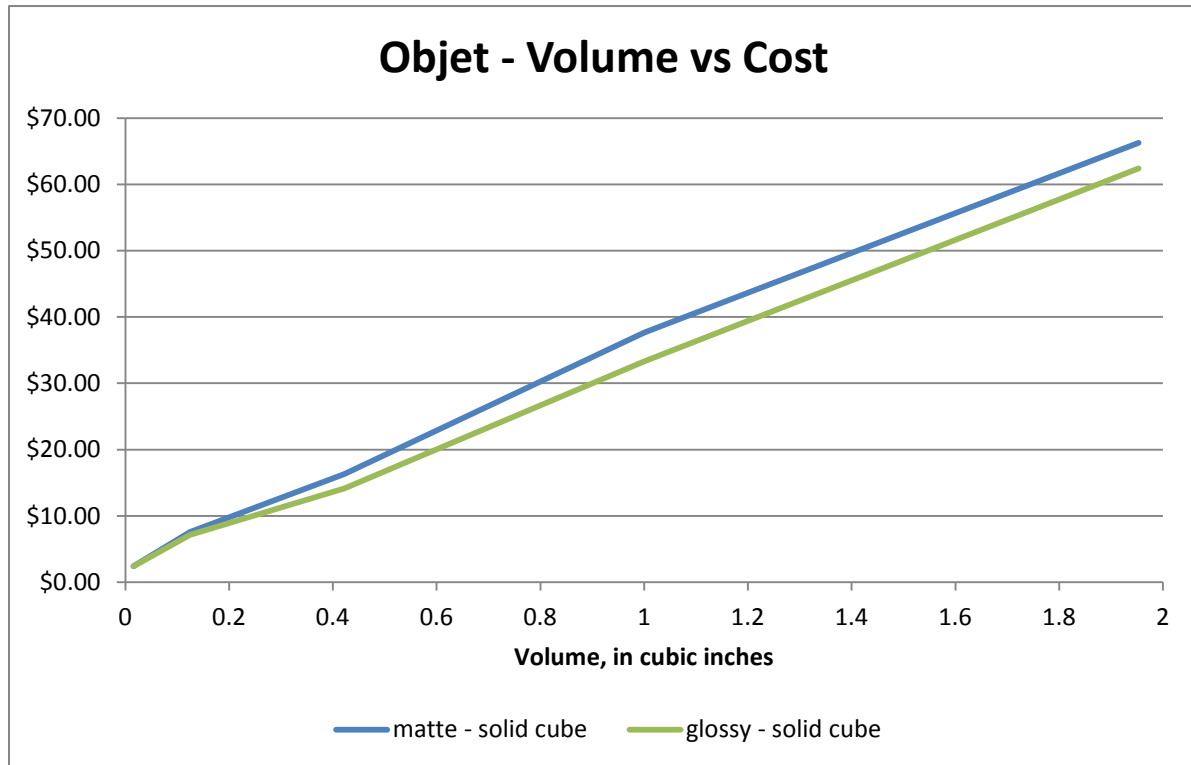
To reduce material consumption and part cost, parts can be printed as a shell filled with support material, and the shell thickness can be specified. You must specify in your print request if a part is to be shelled, and specify shell thickness. Shelling will result in internal support material that cannot be removed. This will lower order cost, as support material is significantly less expensive than model resin.

Coating:

Parts can be printed with one material, and coated with another. The thickness of the coating is completely customizable. The overall dimensions of the part will be maintained as they would without a coating.

Part Cost:

The part cost is dependent upon the amount of resin used during printing. There is no direct, foolproof comparison between the volume of the part and resin used during printing, but to help give you an idea, the cost of printing a single cube of varying volumes is graphed below.



Submission checklist:

- **Why do my parts require the Objet machine?**
- **Does my part fit on the print tray? (check maximum dimensions)**
- **Do I have any wall thicknesses less than 0.015" (0.38 mm)?**
- **Is my required material currently installed in the machine?**
- **Should parts be cleaned manually to avoid breaking fine features?**
- **Can my part be printed with Glossy finish, to reduce material use and cleaning?**
- **Can my part be shelled (printed with support material in the interior) to reduce part cost?**

For more detailed information regarding the Objet machine, such as printing parts with multiple materials, please see the "Details for the Objet 260 Connex" document on the main page of the Sharepoint site.

SUBMISSION GUIDELINES:

(Failure to follow these guidelines may result in your order being returned for correction)

Be sure your parts are finalized before submission. Once submitted, the order will be processed and put into the queue. Any changes after the files are processed will cancel your current order, move the resubmitted parts to the end of the queue, and will cause delays for the rest of the queue.

DO NOT submit one quote request with parts for both machines. Submit quote requests for each machine separately.

The file format that is submitted must be .stl, which can be created from most CAD software. You can access instructions on creating the .stl file for printing from SolidWorks or Pro-E on the share point site: <https://sharepoint.wpi.edu/academics/ME-PROTO/default.aspx>. This is also the site which you should use to submit your order.

When you submit your parts via the sharepoint site, please submit multiple parts via a single .zip file. DO NOT submit a different order for each part, if submitting all parts at the same time. Also, if you want multiple copies of a certain part, do not submit two identical files. Indicate the desired number of copies in the order description.

To request the **Objet machine**, you must precede your order title with **[OBJET]**. If this is not included your order will be processed and printed on the Dimension machine.

Description field checklist:

- Briefly describe the nature of the parts. You don't need to include the entire project report, but give the machine operator a general idea of what the parts will be used for.
- List the number of copies required for each file.
- *Dimension machine:*
 - Specify any required print density required for each part
 - Describe any required print orientations (without referencing your coordinate system)
 - Specify any required part colors
- *Objet machine:*
 - Specify required material(s) for each part
 - Material properties (rigid, plastic-like, flexible, rubber-like, etc.)
 - Material color requirements (transparent, opaque, etc.)
 - See the document "Objet Material Information.pdf", posted on the main page of the RP sharepoint site for more detailed information

IMPORTANT

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