Before printing checklist
- ❏ Your part is suitable for printing on the Form 2
- ❏ Preform reports a green check for Printability
- ❏ You selected the correct resin and layer height
- ❏ You scheduled the print time and material usage
- ❏ The print file is loaded onto the printer
- ❏ The resin cartridge vent is open
- ❏ The build platform is appropriately mounted
- ❏ You will wait for the first layer to start before leaving the shop
- ❏ You can return after the print to complete the washing and post-curing of your parts

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Safety

Uncured Form resin should **not contact your skin**. To avoid resin contacting skin:
- Wear gloves when handling uncured parts
- Confine resin and uncured part handling to the area marked around the printer
- Do not use gloves (which may have contacted resin) to handle any machines as you may transfer uncured resin to knobs and other surfaces
- Clean all tools and your work area with >90% IPA after use (some machine surfaces should NEVER come into contact with >90% IPA so make sure you do not get resin on the machines)
- Leave all dedicated tools (tweezers, spatula, flush cutters) in the printer area and DO NOT use any other tools on uncured parts

Introduction

The Form 2 is a resin based SLA (stereolithography) 3D printer that constructs your part by using a laser to cure thin layers of liquid resin. The final shape is built by curing many overlapping 2D layers and it is important to think critically about this process to avoid failures. Formlabs (the maker of this printer) provides excellent online documentation: https://support.formlabs.com/s/article/Manuals-and-documentation?language=en_US#form-2 **However**, always follow the procedures in this guide. If you think you need to deviate from this guide contact us before proceeding so we can determine the right procedure and update the guide as needed.

Keep things clean

Resin based printing is messy. As mentioned in the safety section, uncured resin should **NEVER** contact skin. Uncured resin is also very sticky and will immediately stick to any surface

it touches. It is **VERY** important that the printer area be clean and tidy to make it easy to see that all areas are clean before and after using the printer. If the area is not clean and organized, uncured resin is left on surfaces outside the printer or uncured resin is found on any surfaces outside the printer area you **will lose the privilege to use the printer.**

Machine overview
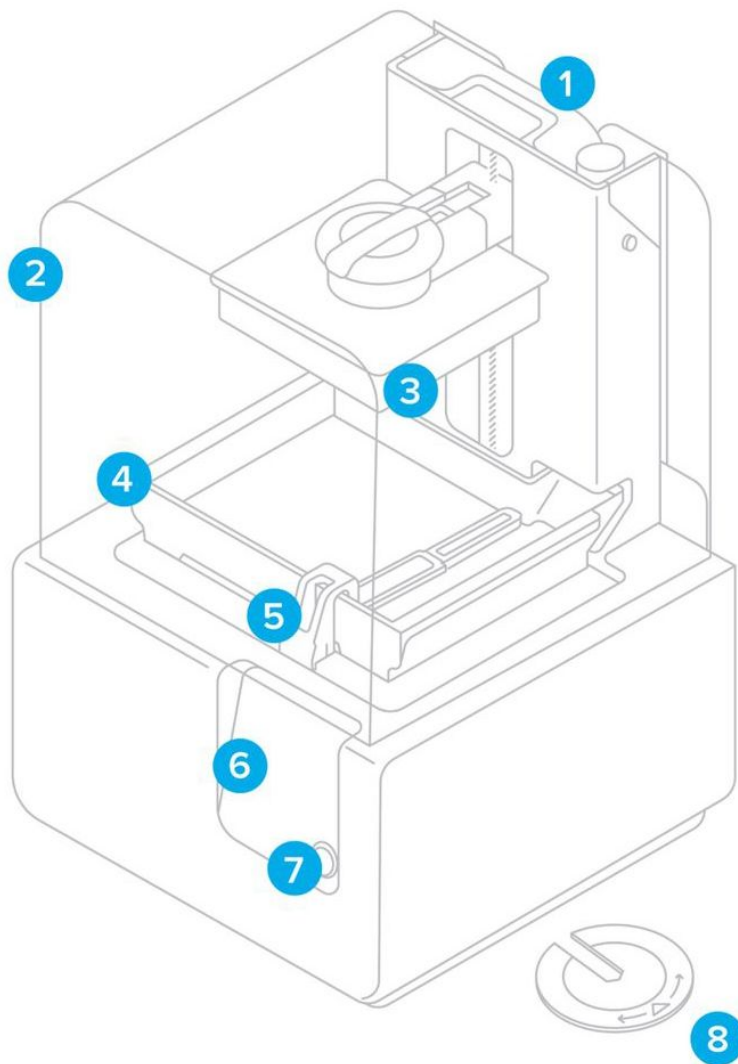
Some key components are:
1. Resin cartridge
2. Cover (keep this closed when not in use to avoid contaminating the resin with dust)
3. Build platform
4. Resin tank
5. Wiper
6. Touchscreen display
7. Button

Designing your part

You will need a printable STL file. These can be designed in any 3D CAD package (Solidworks, Autodesk Inventor, Fusion 360, etc). Creating a printable 3D design can be a complex process as certain features cannot be produced by a 3D printer. Formlabs offers a useful design guide that describes some design constraints:

https://archive-media.formlabs.com/upload/formlabs-design-guide.pdf

Some additional pointers are:

- Never print a model with hollow areas as these will trap uncured resin. Instead, add drain holes to your model and make sure they are oriented to allow the resin to drain during printing
- Avoid cup shaped features as air can be trapped inside the cup and cause obstructions to the flow of uncured resin and suction forces during printing can cause the cup shape to deform
- As every model will be printed with supports, think about where you want these supports and how you will remove during the design of the part
- Your STL must contain a manifold mesh (see this reference for common STL errors: https://www.3dhubs.com/knowledge-base/fixing-most-common-stl-file-errors/

Please contact us if you have any questions and/or would like to discuss your design.

Setting up your print

To make your STL printable it must be 'sliced' into many overlapping 2d shapes. Slicing is performed using PreForm (installed on the computer next to the printer).
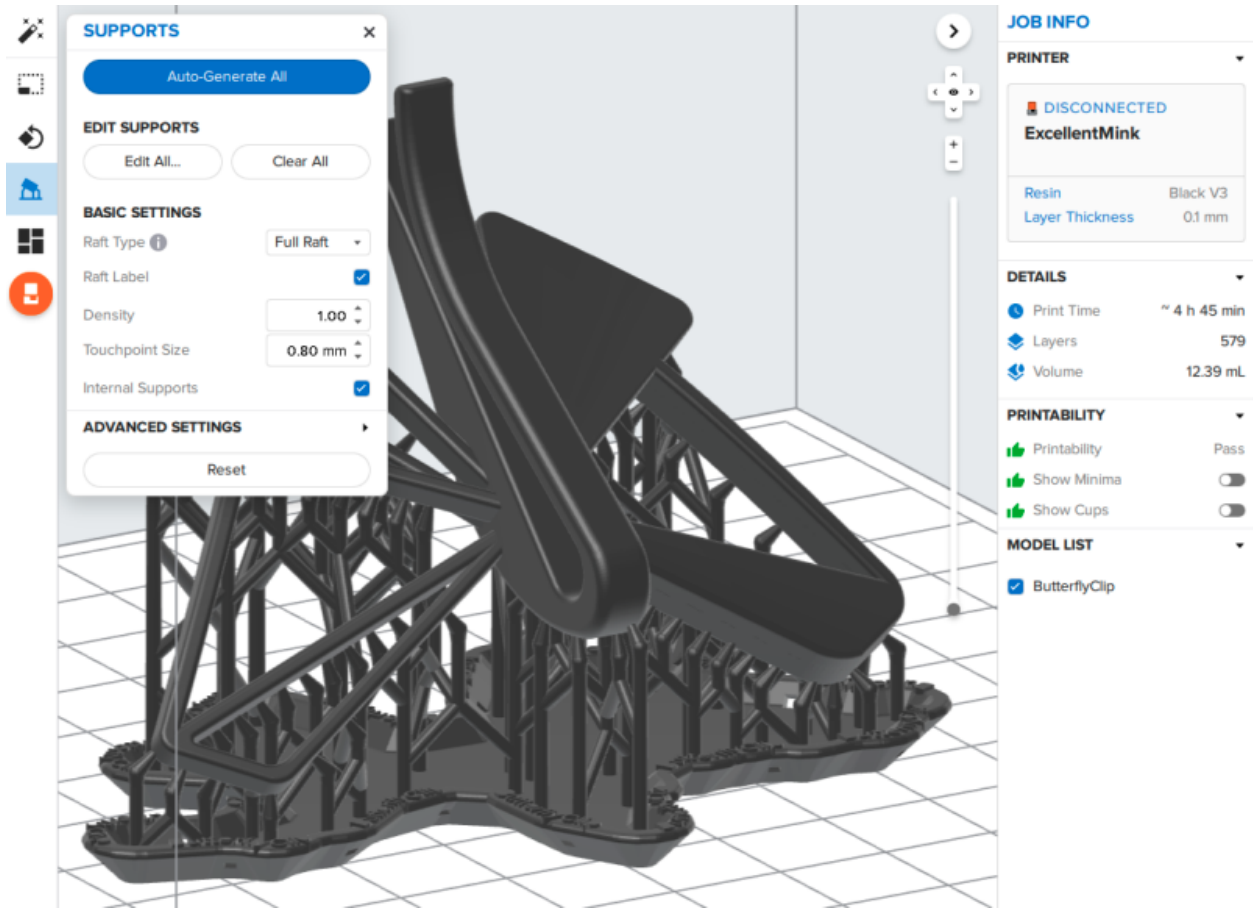
Visit the link below to watch a short (6 minute) video that will introduce you to PreForm and show you how to add a model, setup and perform slicing and finally how to send the sliced design to the printer.

https://support.formlabs.com/s/article/PreForm?language=en_US

It is important that your model always pass the printability test (showing the green thumbs up for "Printability") before printing. Never proceed if the printability test fails and instead contact us for help.

Although the Form 2 supports many resin types we only use clear and gray resin as those are the least problematic for printing. Make sure to confirm you've selected the material that is loaded into the printer in PreForm before sending your print to the printer.

Print with the thickest suitable layer height as your prints will take less time and the printing process will be more reliable.

Starting your print

After slicing PreForm will show you an estimate for your print time and material used. Take note of both of these values and **schedule your print time** at https://www.ntcore.org/formlabs

After you've sent your print to the printer use the touchscreen to select and start your print. Make sure to not wear gloves when touching the touch screen to avoid unintentional resin contamination.

When you start your print you will be asked to confirm several things. It is important that these checks are done for every print as failure to do so can result in permanent damage to the printer.

The printer will ask you to confirm that the build plate is installed. See the below diagram (from Step 6 of the Preparing section of the Quick Start Guide). Make sure to align and insert the platform (#1) and to lock it in place using the locking lever (#2)
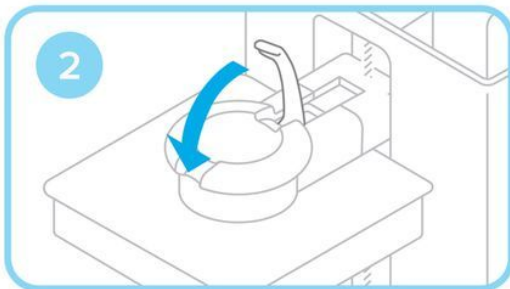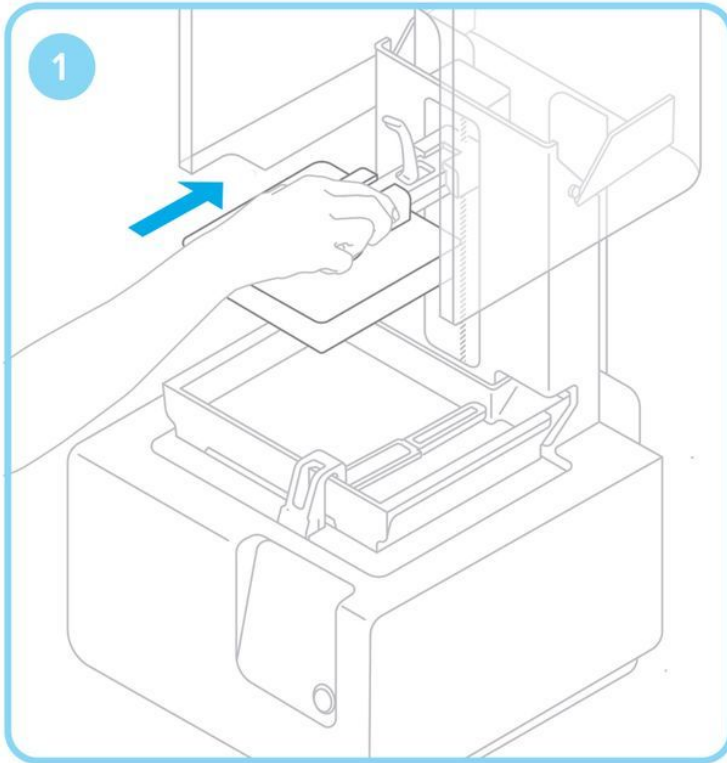
The printer will ask you to confirm that the resin cartridge vent is open. See the below diagram from Step 7 of the Preparing section of the Quick Start Guide. Make sure the vent is in the opened (pictured) position before printing.
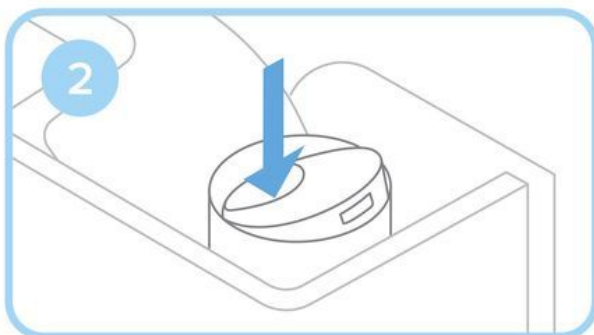
There are a few warnings you may see when you start printing. If it is not one of the below warnings/errors contact us immediately and do not proceed with printing.

If you receive a 'Cartridge Low' warning (below) the printer may not have enough resin to finish your part. The printer tends to underestimate the amount of resin left. Look carefully at this warning to make sure it is not a "Cartridge Dispense Error" or failed to dispense resin error. If you've confirmed that it is only a 'Cartridge Low' warning, please continue with your print and contact us to let us know the resin is low. For any other errors do not proceed and contact us immediately with a picture of the error message.

Changing material

NEVER change the resin cartridge. The resin cartridge is poorly designed and installation errors (even following the appropriate procedures) can result in permanent damage to the printer. If the printer is out of resin contact us (and let us know the name of your print) and we will replace the cartridge.

Monitoring your print

You must stay in the shop and watch the printer until your first layer has started. As seeing the first layer is difficult please look at the touchscreen to display that the printer has started your first layer. After your first layer has started you can leave the printer unattended.

If you see a print failing contact us immediately and pause the printer (using the touchscreen).

For long (>12 hour) prints, periodically check the printer to be able to stop failures before the printer harms itself.
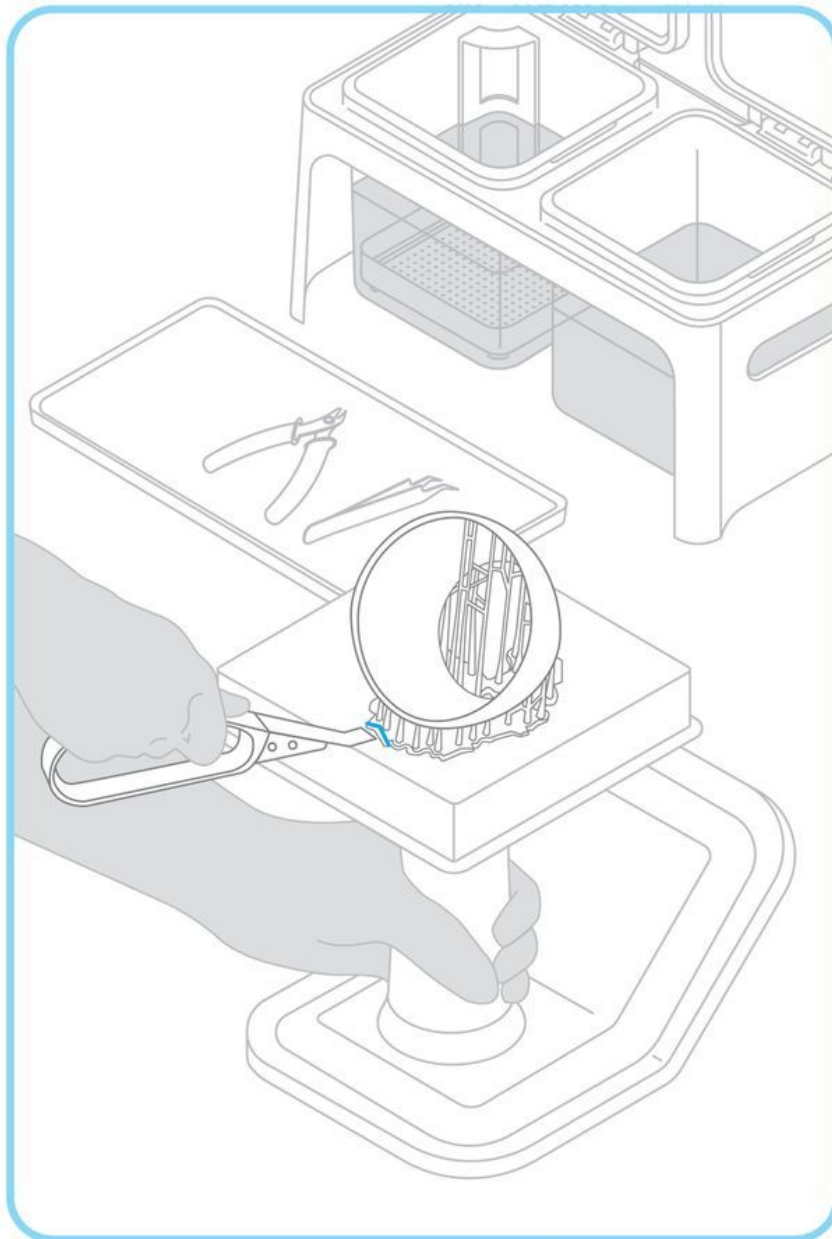
Removing your part from the printer

Put a glove on your dominant hand.

Take care while removing the build platform (with a gloved hand) that you **do not allow resin to drip anywhere outside of the resin tank**. Flipping the build platform while sliding it off the support (#1) can help in the process.
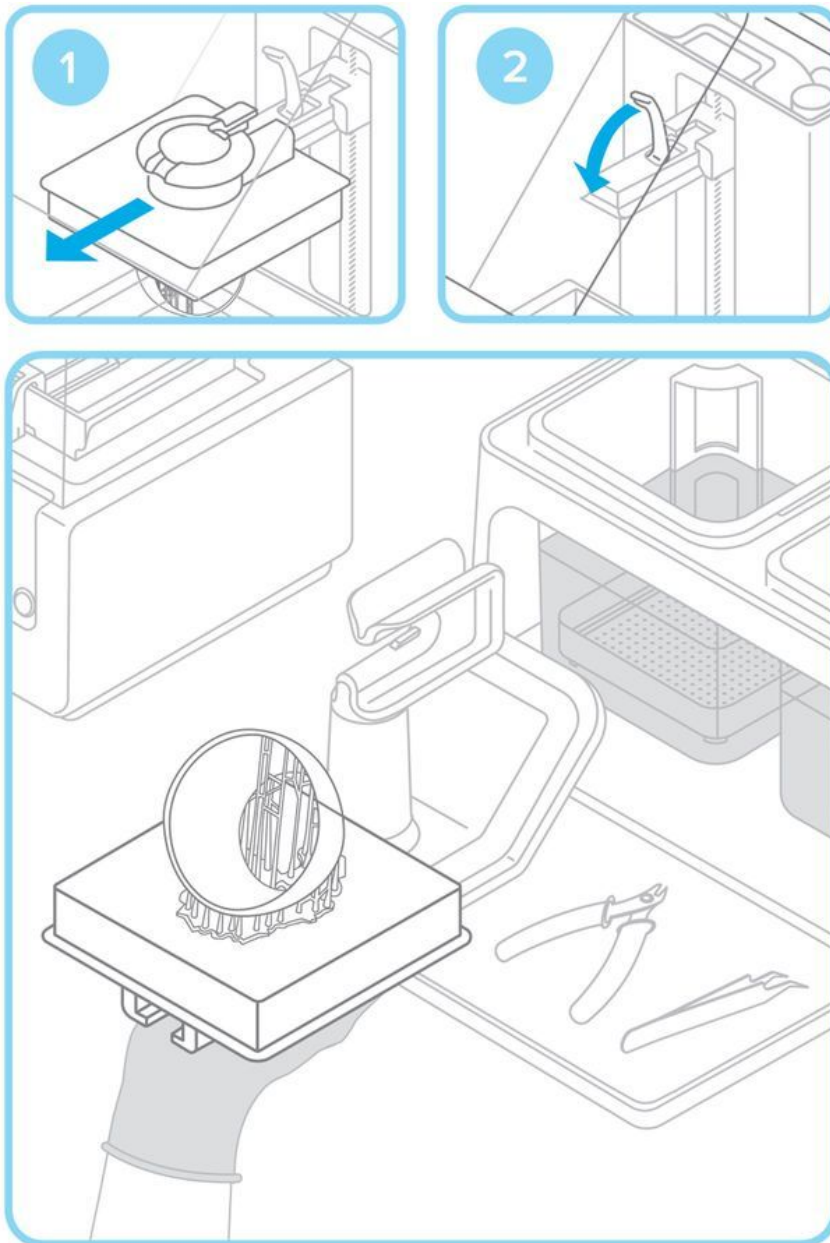
Make sure you close the printer cover (with your ungloved hand) after removing the build platform to prevent dust from contaminating the resin.

Put on a second glove and use the spatula to remove your part from the build platform and put it into either the wash basket (more on this below) or onto the black tray. **Take care** to not allow your part to fly loose during removal as it may damage your part and will cover any contacting surfaces with uncured resin. It can be helpful to put the wash basket on the black try and pry off your part while holding the build platform with part facing down and mostly in the basket.

Washing your part

The Form Wash machine is used to wash your parts with IPA after printing.

To remove the wash basket from the Form Wash use the front knob with an **ungloved hand** (rotate to change selection, press to select) to 'Open' the Wash. This will automatically open the machine and raise the basket. After the basket is fully raised, lift it to remove it from the two back supports (take note of how the basket was mounted as you will return it to this position after loading it with parts.

Load your parts into the basket. If the parts are too small and may poke or fall through the mesh use the nearby tea/mesh balls to hold your parts or wash them by hand (https://support.formlabs.com/s/article/Form-2-Basic-Finishing-Steps?language=en_US).

After your parts are loaded, return the basket to the Wash and use the knob to select 'Start' to have the basket automatically lower and the wash cycle commence. Your parts will be washed for 10 minutes (or whatever time is set on the Wash) and then the basket will be raised to allow them to drain.

After your wash finishes, allow the parts to drip dry for 5-30 minutes. It is **important** that you remove your parts and put the Wash into 'Sleep' mode (which lowers the basket into the machine). Failing to do so will result in excessive solvent evaporation and poor performance of the machine.

Post-curing

Post-curing is an important step that finishes your part by providing it with a smooth non-sticky surface and gives your part a final bit of extra strength by bathing it in UV light at an elevated temperature.

After washing and your parts are **completely dry,** open the cover with an **ungloved hand** to the Form Cure station and place your parts on the mesh circular turntable using a gloved hand. Use an **ungloved hand** to operate the control wheel to set the time and temperature for the post-cure. For clear v4 resin the recommended settings are 15 minutes at 60C. See this reference for other resins:
https://support.formlabs.com/s/article/Form-Cure-Time-and-Temperature-Settings?language=en_US

After your parts are loaded and the cover is closed with an **ungloved hand**, select 'Start' to begin the post-curing process.

After post-curing your parts are safe to touch with bare hands (although the part is not compatible with extended skin contact).

Cleaning up after your print

It is important that you **clean all surfaces that contact uncured resin promptly with >90% IPA**. Lower concentrations of IPA are unsuitable for cleaning up resin and if left uncleaned this resin can cure to surfaces or be touched by other shop users. You should clean after removing your parts from the printer and loading them into the Wash station. You may need to clean other items between washing and post-curing depending on what surfaces your parts touch. Make sure to check and clean all surfaces including:

- Lab bench
- Black plastic tray
- Tools including the spatulas, flush cutters, tweezers
- Any mesh/tea balls used

If any machines come into contact with uncured resin (outside of the resin tank), please take a picture of the spill and send it to us to determine the correct cleanup procedure. **Many machine surfaces should never be cleaned with IPA as this will damage the surfaces**.

If you find the area is not appropriately clean please send us a picture so we can determine what to do.

Sharing the equipment

Every tool in the shop is shared equipment.

Leave the printer and area cleaner than you found it.

If you want to start a print and parts are on the build plate you will need to completely finish them by cleaning and post-curing the parts.

Promptly remove, clean and post-sure your parts after printing so other users can use the printer.

Do not schedule time that overlaps with another user's scheduled print time.

If you find the printer in operation and it is unscheduled please contact us before proceeding.