

LOCATION OF WORK:	WRITTEN BY:	APPROVED BY:	DATE :	LAST REVISION:
All Schools	L. Carriere David Wall Vince Pearase	School Principal	April 20, 2015	July 11, 2017

HAZARDS PRESENT	PERSONAL PROTECTION EQUIPMENT (PPE)	ADDITIONAL REQUIREMENTS
<ul style="list-style-type: none"> • High temperatures (230°C), burns • Moving parts, Pinch Points • Hazardous fumes • Electrical shock • Interferes with radio and television reception 	<ul style="list-style-type: none"> • Long and loose hair must be tied back • Do not wear loose clothing or jewelry 	<ul style="list-style-type: none"> • Equipment orientation • Additional Exhaust Ventilation

SAFE WORK PROCEDURE

DO NOT use this machine without teacher supervision and the teacher has instructed you on its safe use and operation and has given permission.

PRE-USE INSTRUCTIONS:

1. Ensure that the electrical power cord, wall receptacles and operating switches are undamaged and in good working condition.
2. Ensure all safety devices and shields are in place and in good working order.
3. Always ensure that the machine is plugged directly into an outlet. **DO NOT** use an extension cord.
4. Good housekeeping habits must be employed and the floor and surrounding area must be dry and free of tripping hazards.
5. Keep hands and utensils out of the machine while in use to reduce the risk of severe injury to hands or damage to the machine.
6. Never open the lid during operation.
7. Ensure the printer is set on a flat, even and steady surface.
8. Ensure additional exhaust ventilation is present to remove the fumes given off by the PLA Filament.
9. Machine must be supervised by a trained teacher at all times while students are working around the equipment.
10. Staff must have the current MSDS for the filament being used in the printer. **Note:** filaments bought from different manufacturers will have different MSDS's. If it is determined that the filament gives off hazardous fumes during the heating process you will not be able to use it. ABS filament should not be used as it gives off very hazardous fumes.

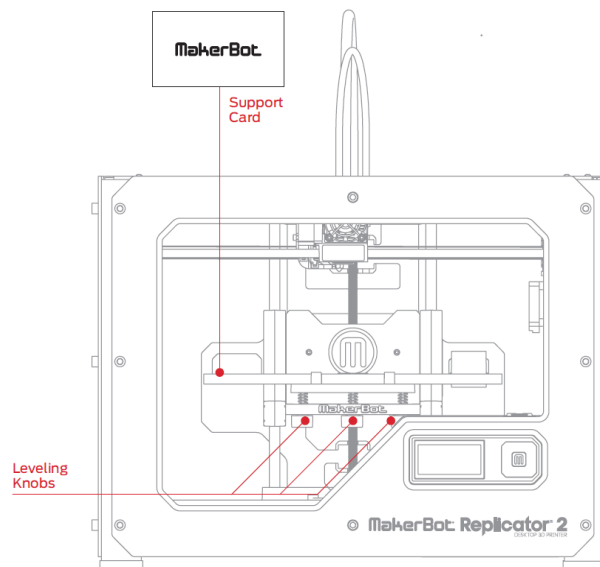
OPERATING PROCEDURE:

1. Plug the AC power cord into an electrical outlet (6.25 amp requirement).
2. Set the power switch to the ON position. The LCD panel will light up, display text and run through the start-up script.

3. Level the build plate:

- a) To level the build plate you must adjust the three knobs under the build platform. These three knobs lower and raise the build plate.
 - Tightening the knobs [turning them to the right] moves the build plate away from the extruder nozzle.
 - Loosening the knobs [turning them to the left] moves the build plate closer to the extruder nozzle.
 - The distance between the extruder nozzle and the build plate should be about the thickness of the MakerBot Support card.
- b) The LCD screen will direct you to tighten each of the three knobs under the platform about four turns.
- c) The script will then prompt you to adjust the knobs individually. Ensure you can just slide the MakerBot Support card between the nozzle and build plate without damage to the card.
- d) The script will prompt you to adjust each knob again for fine tuning.
- e) The script will prompt you to confirm that the MakerBot Support card slides between the nozzle and plate with a moderate amount of friction.

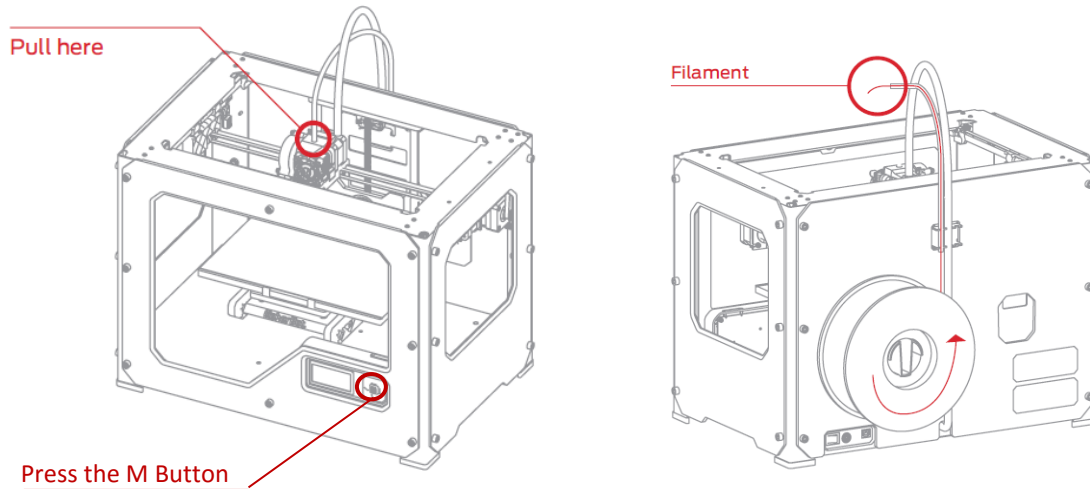
Note: If you have problems, or if you need to level your build plate again, you can use the up and down arrows to scroll through the top-level menu on the LCD panel and use the M button to select Utilities. Scroll to Level Build Plate and select it. You can use these menus to return to the levelling script at any time.



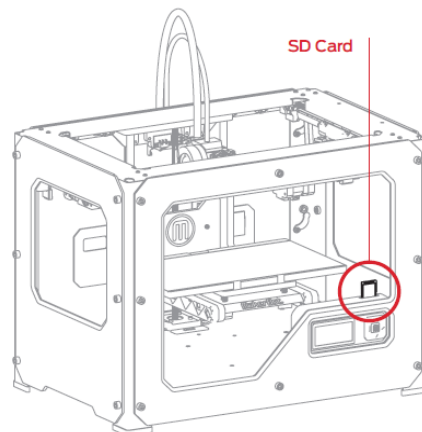
4. Loading the MakerBot PLA Filament:

- a) Remove the end of the filament guide tube from the hole in the top of the extruder by gently pulling it out of the hole in the top of the extruder.
- b) Feed the free end of the MakerBot PLA Filament from the filament spool. Cut a clean edge, at an angle, with a pair of scissors. Feed the end of the filament into the end of the guide tube where it attaches to the back of the MakerBot Replicator 2.
- c) Push the Filament all the way through the filament guide tube until it emerges from the other end of the tube. Ensure that the filament coil is mounted so that it unspools counter clockwise.
- d) Press the M button on the LCD menu. The MakerBot Replicator will start to heat the extruder. Caution Do NOT touch the extruder while it is heating (230°C).
- e) After the extruder reaches 230°C the LCD panel will prompt you to press M when you see the plastic extruding.

- f) Push down on the Extruder Arm. Continue to hold it down as you insert the free end of the MakerBot PLA Filament into the hole in the top of the extruder. Push it in as far as it will go. Plastic will start to emerge from the extruder nozzle. Release the arm
- g) The extruder motor will grab onto the filament and continue to draw it in. Watch to ensure plastic is still extruding from the nozzle after you release the extruder arm. Then press the M button to stop extrusion. Wait for the MakerBot PLA Filament to heat and extrude.
- h) Push the guide tube back into the opening on top of the extruder.
- i) Wait a few minutes for the extruded PLA to cool, then pull it off the nozzle. Discard the extra filament. Don't touch the nozzle; it may still be hot. Don't leave plastic clinging to the extruder nozzle. This can cause newly extruded plastic to stick to the nozzle instead of the build platform.



- 5. Locate the SD Card – the SD Card is located in the SD port directly behind the LCD Panel.
- 6. Select a project from the SD Card:
 - a) After you have levelled the platform and loaded the filament the LCD panel will ask you if you are ready to build something. Use the up and down arrows to select a model. Press M
 - b) The MakerBot will begin to build the project. You can use the LCD panel to monitor the temperature of the extruder, status and progress of your object.



- 7. Once the project is completed unload MakerBot PLA Filament:
 - a) Go to the LCD panel and select Preheat > Start Preheat.
 - b) Wait for the extruder to heat to the set temperature.
 - c) Push down on the Extruder Arm and continue to hold it down as you gently pull the filament out of the extruder.
 - d) Release the extruder arm.

USING THE MAKERBOT WITH A COMPUTER:

1. Use the supplied USB cable to connect your MakerBot Replicator 2 to your computer.
2. Download and install the MakerBot MakerWare. (makerbot.com/makerware)
3. Download an object from MakerBot Thingiverse, which is a design file share website for MakerBot users. (www.thingiverse.com) Save the project file to your computer.
4. Open the MakerBot MakerWare.
5. Open the files in the MakerBot MakerWare by clicking on the add button.
6. Turn / adjust the size / add more than one model / etc. Once your model is to your liking click on the save button and save your file as an STL or .thing file.
7. Click on the make it button. The dialog box will prompt you to choose the following:
 - a) Make With – select the Replicator 2
 - b) Material – choose the plastic you are building with
 - c) Quality – specify the quality
 - d) Raft – build your project on a raft (base support)
 - e) Support – includes easily removable support structures.
 - f) Advanced Options – menu with more options.
 - g) Cancel – cancel's this process
 - h) Make it – sends the file to start building the project.
8. Click the Make it button and start building. Do not touch the MakerBot while the unit is running. Fingers could get caught in the moving parts.
9. As the build progresses, melted PLA filament gives off fumes. Do not breathe in the fumes. Ensure additional exhaust ventilation is present while operating the MakerBot.

REMOVING THE PROJECT FROM THE MAKERBOT:

1. Wait for the object to cool down. Objects will detach more easily after they have cooled.
2. Slowly lift the project at an angle and peel it off the build plate.
3. If the object is stuck, take a thin metal craft spatula and carefully work the blade under the edge of the object. When the blade is most of the way under the object, twist the handle slightly. The object should come free.
4. Alternately, you can cover the build plate with blue tape. This allows the object to stick to the build plate but be removed easily. Clear, bare acrylic plates can also be used in place of the tape.

PREVENTATIVE MAINTENANCE:

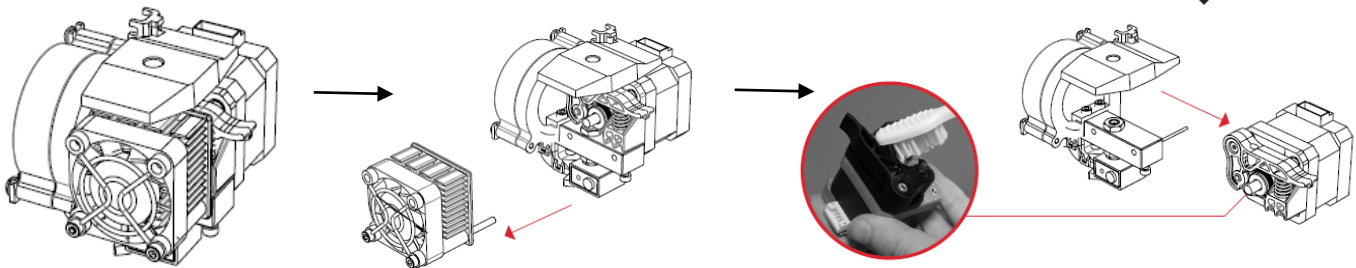
1. After 50 hours of build time:
 - a) Lubricate the threaded rod on your Z-axis and the X-axis idler pulley using the PTFE based grease.
 - Grasp both sides of the build platform and push it gently to the bottom of the MakerBot.
 - Spread the PTFE-based grease onto the top section of the threaded rod as well as the inside of the threads.
 - Grasp both sides of the build platform and move it to the top of the MakerBot
 - Spread the PTFE-based grease onto the bottom section of the threaded rod as well as the inside of the threads.

- b) Lubricate the threaded rod and X Axis idler pulley:
- Locate the X-axis idler pulley. If you are facing the front of the MakerBot the idler pulley is at the top left side. Squeeze a small amount of the PTFE-based grease directly onto the exposed area of the dowel inside the idler pulley.
 - Manually move the pulley back and forth to spread the grease.

2. Clean the drive gear, frequently:

- Remove the PLA Filament from the extruder.
- Unscrew the two bolts at the lower corners of the fan guard.
- Remove the fan guard, fan, heat sink and spacers.
- Unclip the motor wires
- Pull the motor assembly out.
- Find the drive gear on the motor shaft. Remove all piece of the filament stuck to it.
- Reseat the motor assembly.

- Plug in the motor wires
- Install the fan guard, fan and heat sink.
- Reload the PLA filament.



If and emergency situation occurs while conducting this task or there is an equipment malfunction, shut the equipment off immediately and unplug it.

REPORT ANY HAZARDOUS SITUATION TO YOUR INSTRUCTOR / SUPERVISOR IMMEDIATELY

REGULATORY REQUIREMENTS

- WS&H Act W210, Section 4, 5, 7, 7.1
- Mb. Regulations 217/2006,
 - Part 2, Safe Work Procedures
 - Part 16, Machines / Tools and Robots
 - Part 17, WHMIS Application
 - Part 36, Chemical and Biological Substances
- Owner's Manual