

## Ender 3 Check-Out Guide



### Kit Items:

- Creality Ender 3 printer
- Case for hand tools
- Power cable
- Spool holder (with t-slot fasteners)
- Scraper
- Snips
- MicroSD card
- MicroSD card to USB-A adapter
- wrenches (x2)
- Allen wrenches (x5)
- Small flathead screwdriver
- Unclogging needle

### CHECK-OUT EXPECTATIONS

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Hello and welcome to at-home 3D printing! To assist with remote learning and project prototyping, Cal Maritime now offers 3D printer check-outs of Creality Ender 3 printers.

Limited printers are available, so they will be offered in the following order of priority:

- 1) Students whose professors have requested the printers for their class
- 2) Students working on academic/class projects in order of seniority

Printers are lent out for up to a semester, with an anticipated return date required at check-out. They are to remain at the location listed on the check-out form. You will be responsible for any lost parts or damage incurred by the printers. The better you treat this printer, the more use you and your fellow students will get from it. So, take care of it!

All kits should be checked for completion upon check-out. All parts must be returned with the printer, except the unclogging needle if too bent.

The following guide outlines the basics of using this printer and some best practices for its longevity.

If you have any questions or concerns about the lending program or the printer, please reach out to the Makerspace Technician, Erin Cole at [ecole@csum.edu](mailto:ecole@csum.edu) or (707) 654-1231.

## SAFETY PRECAUTIONS

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- Carry the printer from the bottom, and not by the extrusions, as much as possible
- Put the printer on a **flat** surface with enough space around it that all parts of the printer can move freely
  - Especially the build plate
  - Make sure that the printer isn't sitting on top of any cables
- **Fire safety:** there is an element of fire danger to these printers
  - Don't leave the printer unattended for long periods of time
  - Keep the area around the printer clear
    - Especially of debris that could interfere with the printer, or any materials that are heat sensitive or flammable
- Don't touch the printer nozzle while it's hot, and be mindful that the build plate can be too hot to touch sometimes (based on material settings)

## GETTING STARTED

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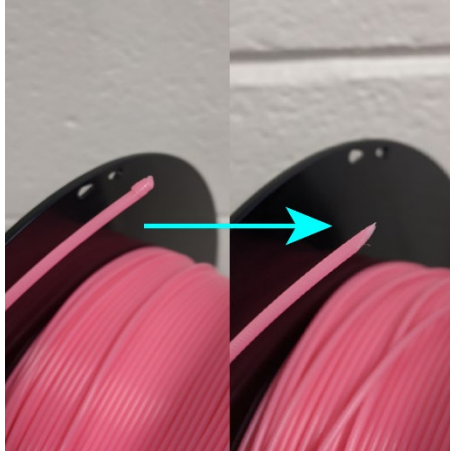
### Software:

- To generate 3D models:
  - You'll need a .STL or .OBJ file
  - Any CAD program will do! (e.g. Solidworks, Inventor, Fusion360, TinkerCAD)
  - Or, download open source models from websites like [thingiverse.com](http://thingiverse.com) or [prusaprinters.org/prints](http://prusaprinters.org/prints)
- To prepare 3D models for printing:
  - Download [Cura](http://Cura), a free slicer from Ultimaker
    1. A slicer is a software that translates your model into settings and commands that the printer can read (in .gcode). It gets its name because it cuts (slices) your model into horizontal layers.

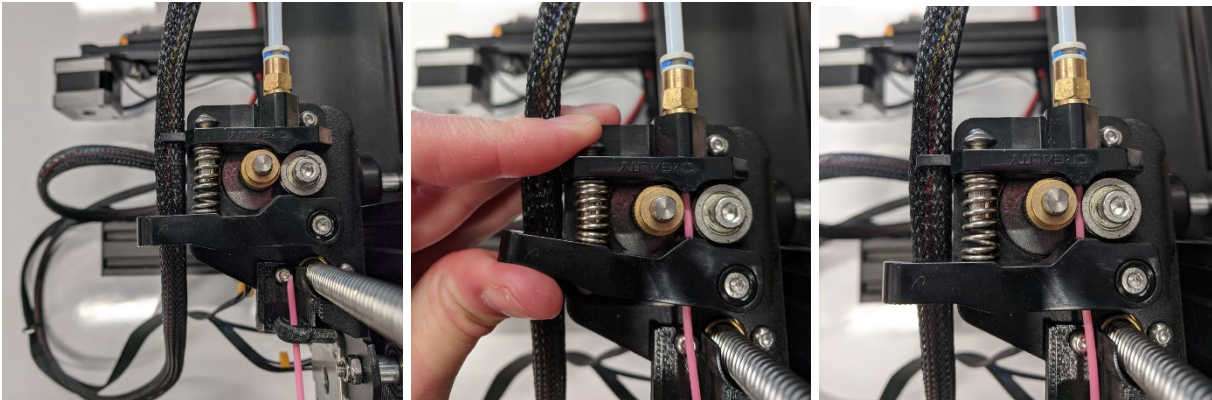
### Prepping the printer:

- Load filament
  - The Ender 3 uses a [Bowden Tube extruder](#), meaning the stepper motor that pushes filament through the hot end is on the frame rather than directly next to the hot end.
  - Steps:

1. Pre-heat the hot end
  - Click the button on the control panel > “Prepare” > “Preheat PLA” > “Preheat PLA End”
2. Cut the tip of the filament to a point using the snips





3. Squeeze the extruder arm and feed the filament through
  - You might need to rotate the filament until it naturally angles into the hole by the Bowden tubing



- Continue to push the filament through gently until it starts coming out the hot end
- Level the print bed
  - The print surface is held on to the printer using small binder clips. This is normally sufficient, but make sure to put them in spots where the extruder won't hit them while printing.
  - The “Ender3\_Bed\_Leveling” gcode should already be on the MicroSD card
    1. If it's not, you can redownload it from Thingiverse here: [bed leveling gcode](#)
  - To run it:
    1. Grab a piece of paper
    2. Plug the MicroSD card into the slot on the front left of the printer



3. On the control panel, click “Initialize TF Card” (if prompted) > “Print from TF Card” > scroll to find “Ender3\_Bed\_Leveling” > click
  - It will move the extruder head to each corner of the print bed twice. At each corner, it’ll pause for you to adjust the spring under that corner with the knobs.

| Clockwise   | Counterclockwise   |
|---|--|
|  <p data-bbox="488 1010 769 1155">Expands spring →<br/>decreases distance<br/>between build plate &amp;<br/>extruder</p> |  <p data-bbox="850 1010 1131 1155">Compresses spring →<br/>increases distance<br/>between build plate &amp;<br/>extruder</p> |

- Put the piece of paper under the nozzle and turn the knob until you can just slide the paper between the nozzle and the bed.
- See this video for more detail on how the paper should catch: [3D Printer Manual Bed Leveling](#)
  - In this video, they do the entire process manually, but the gcode we’ve supplied does part of this automatically
- Once it’s at a good height, click the center button and it’ll move on to the next corner.
- After each corner has been checked twice, it’ll do a test print. If all the circles look fairly uniform and all the lines stuck, the bed is level and you’re ready to print. Otherwise, go through the process again.

## WORKFLOW

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1. Make your .STL/.OBJ file
2. Slice the file in Cura with appropriate settings
  - a. Cal Maritime Makerspace on YouTube: [How to Slice Files with Cura](#)
3. Save the .gcode onto the MicroSD card
4. Pre-flight check on the printer:
  - a. Enough filament?
  - b. Bed clean?
  - c. Bed level?
5. Print
  - a. Check in periodically to make sure it's printing ok
6. Let print cool slightly
7. Remove print from print bed with scraper (or by unclipping the bed & gently flexing it)

## TROUBLESHOOTING

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### Unload Filament

1. Pre-heat the hot end
  - o Click the button on the control panel > "Prepare" > "Preheat PLA" > "Preheat PLA End"
2. Squeeze the extruder arm and pull the filament out
3. Put the end of the filament through one of the holes on the spool to prevent binding

### Extruder Clogs/Filament Jams

- Pause or cancel the print
- Clogs/jams can happen for a variety of reasons. If it's not one of the below reasons, email Erin Cole ([ecole@csum.edu](mailto:ecole@csum.edu)) for additional help or replacement parts.

| Possible Reason for Clog  | Solution  |
|---|---|
| Filament spool is binding (filament is tangled so it's not unraveling smoothly)                           | Unload and untangle filament. Reload.   |
| Nozzle is clogged   | Unload filament. Use unclogging needle to poke through nozzle and clear out filament globs. Reload. |
| Filament has run out (the filament is too short for the gears on the extruder stepper to push it through) | Load more filament.   |

### Print Came Unstuck

- Cancel the print (sad blobs of plastic stuck to extruders are bad news)
- Was your bed temperature setting correct?
- Did you use a raft? If not, maybe try a raft

### Sagging/Drooping Print

- Double check your print orientation
- Did you use supports?
  - If not, add them
  - If yes, consider increasing support density or redesigning your part

## ADDITIONAL NOTES

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### Further Documentation/Sources Referenced:

- [Ender 3 User manual](#)
- [How to Slice Files with Cura](#) (YouTube tutorial from the Makerspace)
- [Bed leveling gcode](#) (should already be on the MicroSD card)
- [3D Printer Manual Bed Leveling](#) (without the leveling gcode)
- [Extensive help guide](#) (from a hobbyist; includes printer assembly)
- [Filament unclogging guide](#) (from Creality—more extensive than you'll need/have supplies for)

### Best Practices:

- Always tuck the end of the filament into the holes of the spool so the filament doesn't get tangled (can cause *binding* while printing, leading to failed prints)
- We've printed fan covers and filament clips to help keep the printers safe:

