FDM Training SOP

Last edited: Furst (08/26/20)

Instructor:

Date:

Attendees:

	Name	Group or Company	Signature
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Overview:

- This training provides an introduction to using and operating the FDM 3D printers including:
  - File Types
  - Software
    - Cura
    - GrabCad Print
  - Printer Use
  - Post processing
  - Printer Maintenance
    - Changing Print Heads
    - Changing Fulfillment Type
    - Cleaning
- The two FDM printers (Ultimaker and F270) are both set up to print with with ABS by default, Other materials are available upon request.
- Work by extruding thermoplastic filament onto build platform-Build the part layer by layer.
- Remember to enter job information into the 3D print job log!

Safety

- The print heads can be very hot - do not touch them with bare hands unless positive they are cool.
- As with any automated machinery make sure that your body is clear of the moving parts to avoid injury.
- The support removal tank for the F270 is filled with heated caustic chemicals that dissolve the support material. An apron, Gloves, and a face shield must be warn when inserting and removing parts or basket from tank.

Job Setup

- **At the Computer:**:
  - Load your STL file into the print software on the computer adjacent to the printer (Cura for Ultimaker, GrabCad Print for F270).
  - Set Print Parameters:
    - Position the part on the build tray in a way that is conducive to 3D printing (flat side down)
    - Select appropriate layer or slice height (the more slices the higher the print resolution but the longer it takes to print)
  - For Ultimaker:
    - Select “generate support” if necessary
    - Check appropriate filament and bed temperatures (should be set if using standard filament load out)
    - Send job to Ultimaker using USB drive
  - For F270:
    - The F270 the printer will print a raft before printing the model. Make sure first layer is set to support material or removal will be incredibly difficult.
    - Send job to F270 over Ethernet
  - Record the material used and print time in the online log along with the other job information requested. The print log should be on the desktop or https://docs.google.com/forms/d/e/1FAIpQLScS3URUxoHOR62PdQeeSTAYg_suV061UsoFafrgoN0qn6DWYg/viewform.
- **At the printer:**
  - Ultimaker:
    - Make sure print bed is clean
  - F270:
    - Make sure that there is enough room on an CLEAN build tray for your part, and that the build tray is secured in the printer with the locking arm horizontal. Build trays may be used until the entire build area has been printed on, but printed areas should ideally not be reused.
  - Start the job at the printer

Part Removal and Cleaning

Ultimaker

- Remove part from print bed using a spatula or razor being careful not to cut yourself or scratch the build plate. Make sure no body part is in line with the tool should it slip or the part break free unexpectedly.

F270

- Don gloves, face shield, and lab coat
- Carefully, slowly and without splashing cleaning solution open the support removal tank lid, remove and open the tank
- Place large parts directly in the tank, small parts may be put in the SS box and placed into the main basket.
- Carefully, slowly and without splashing lower the basket back into the tank and close the lid.
- Set timer for 6 hours setting the temperature to 80 degrees C.

- After cleaning time has elapsed follow the instructions above for opening and removing parts.
- Rinse part in warm water

Rates

F270:

Material	$/Spool	cu in/Spool	$/cu in	$/cc
PLA	79	60	1.31	.08
ABS	164	60	2.73	.17
Sup	228	60	3.79	.23

F270 hourly charge: $1/hr to pay for head replacement

Ultimaker: ABS: .12/gram

Quick Review

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Safety Concerns

- Both print heads and bed are heated during operation. Do not attempt to clean, remove, or adjust without allowing for adequate cool down time.
- Keep hands clear of printer during operation. Pause print before clearing or adjusting print.

Safe Operating Procedures Review

1. Launch Cura version 4 (blue icon)
2. From connected printers, select IW-Ultimaker3
3. Select File → Open Files → Open desired project (.STL file type)
4. Using task bar on the left hand side, position model as desired
5. From print settings, select slice height, infill percentage, and support
6. Support can be generated using ether nozzle, typically nozzle one holds build material with nozzle two printing with dissolvable support material.
7. Setting can be fined tuned using the “Custom” option from print settings
8. Within custom settings, nozzle and build plate temps can be adjusted (build plate temps should be based off of build material)
9. Save the file from Cura on a thumb drive
10. Connect thumb drive to printer → select desired file → select print

Note: Adjusting settings may lead to more (OR LESS) successful prints. Contact Workshop Wizard

responsible for Ultimaker if print fails or knowledge of advanced settings is desired.

Post Processing

- If support was constructed from ABS carefully break away with pliers
- If support was constructed from PVA soak part in warm water for several hours to dissolve support structure

Maintenance

- Bed should be cleaned with IPA between prints
- Print heads and silicone head protector should be cleaned as needed
- Filament should be dried before use if printer has been idle for several weeks
- Bed leveling should be completed every time print cores are swapped
- Print cores should be swapped after clog or to change print line width. Used print heads should be kept for spare parts

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