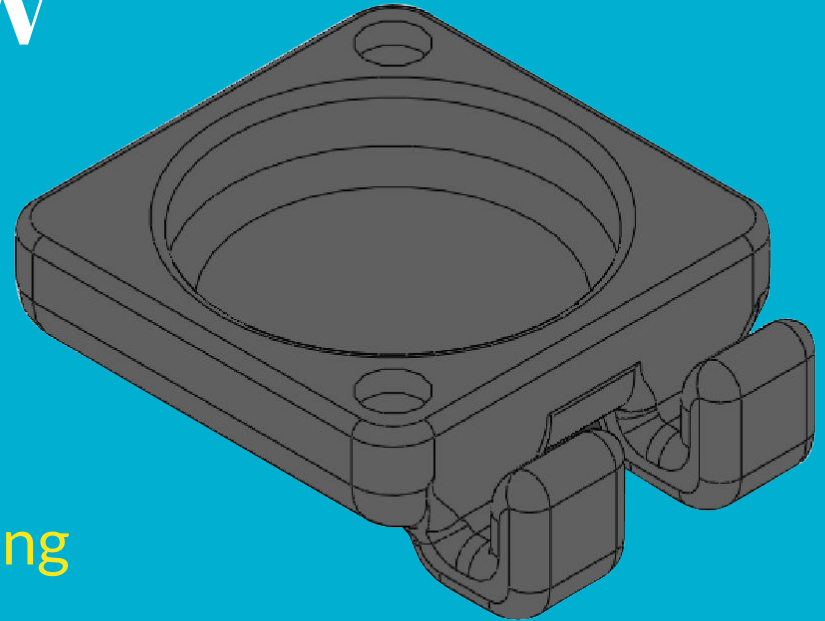


FDM Material Cap: Design Review



Stratasys Direct Manufacturing

Intro:

FDM Machine



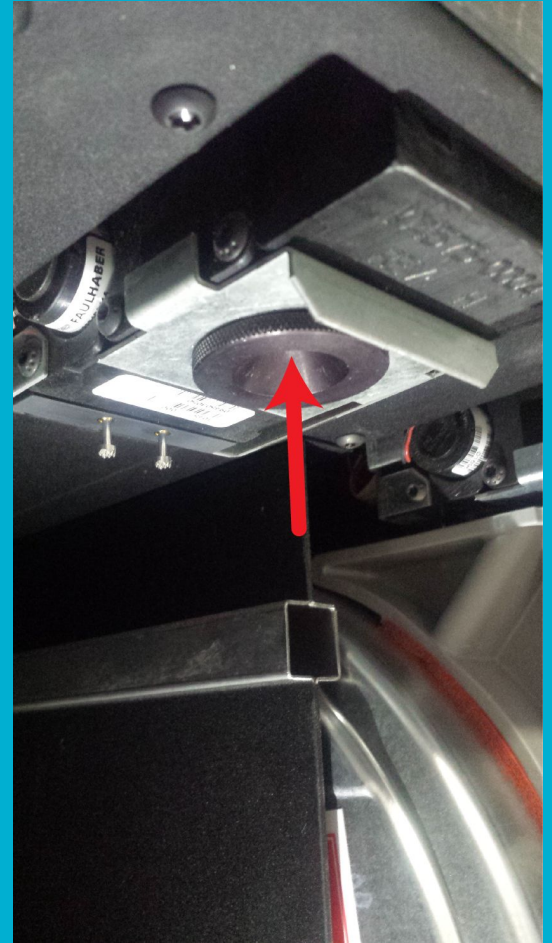
Intro:

Bays for canisters. On the right side of the canister is an example of an open bay.



Intro:

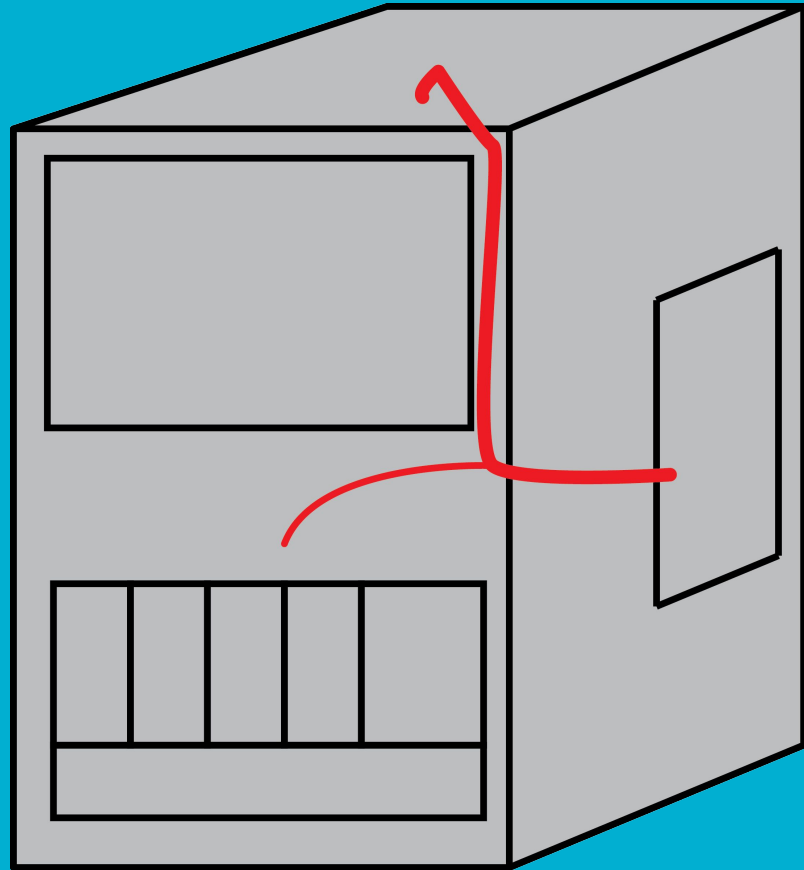
—
In an open bay section, the black metal inlet (material inlet) is used for inserting filaments.



Intro:

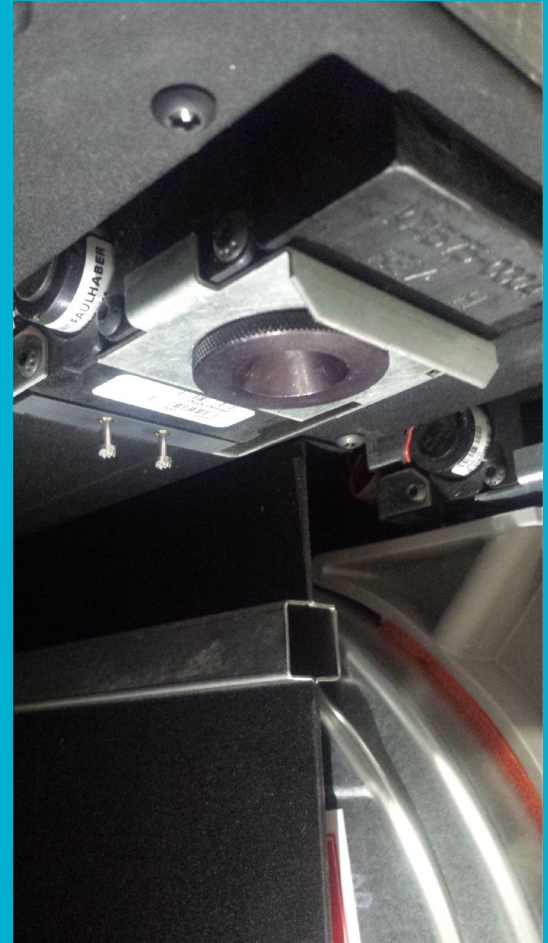
—

Schematic drawing
of a Dry Air System:



Problem:

—
An open bay can potentially decrease the efficiency of the dry air system



Problem:

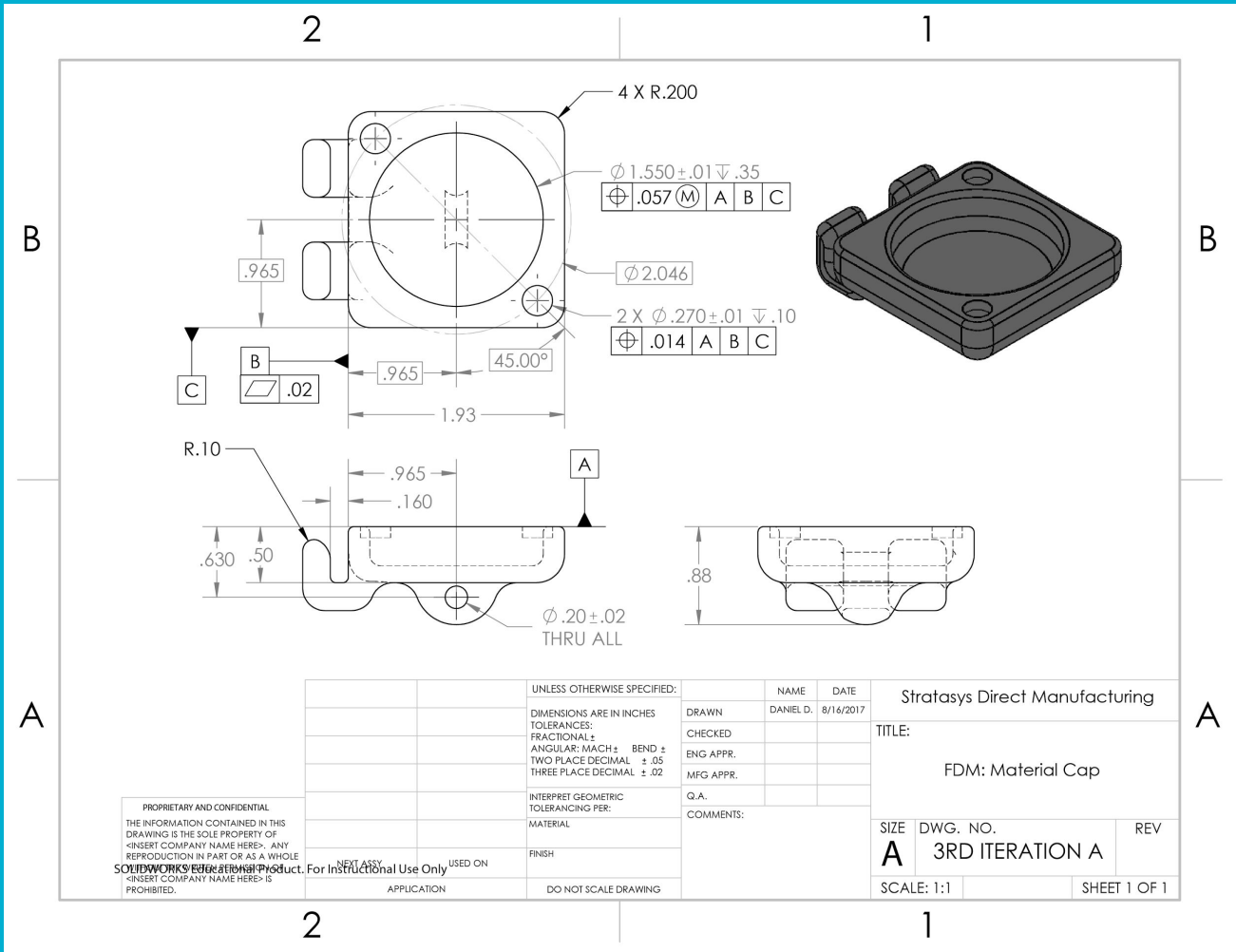
In addition, according to FDM Fortus user guide that was set by the company on page 52, section D:

- D. Need both (or 4 for 4-bay system) canisters present..
 - Indicates that at least one operating canister bay does not have material loaded to the Ready mode (flashing green LED)
 - System operation will not be significantly compromised by this condition. The air-dryer circuit performs more efficiently when all operable bays are Ready.
 - Install canisters to the Ready mode for all operating canister bays.

Solution:

Design a cap to cover material inlet.

Drawing:



Design Requirements

- Mimic canister being sealed to replace canisters
- Hold 0.02 psi without becoming dislodged.
- Can withstand the temperature when printing for Ultem.
- Durability, can endure 5 drops of 3 feet without damaging part.
- Can be easily attached, removed, and stored.
- Mistake-proof, visibility to avoid collision between canister and cap.
- Magnets doesn't interfere with the machines.
- Mistake-proof, design to avoid collision against the transponder.
- Maximum cost of \$30/piece with a batch of 50 pieces.

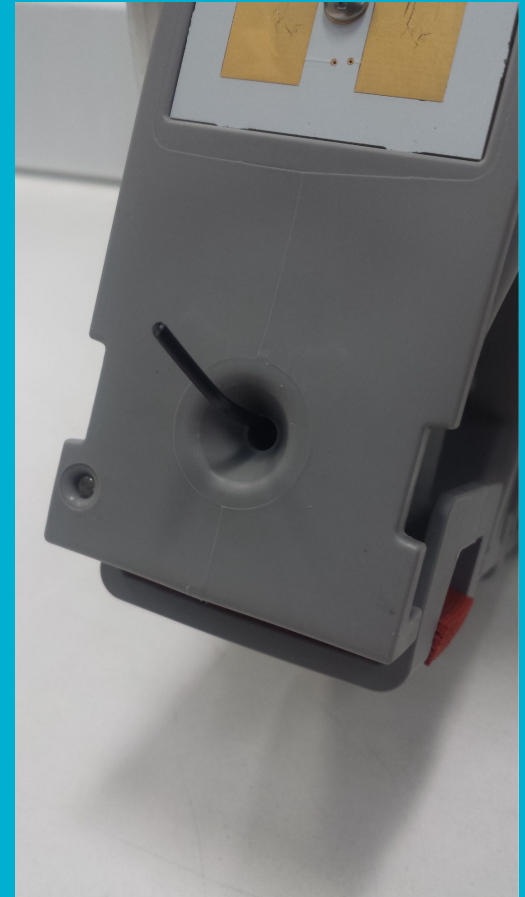
Pressure Resistance

- Manometer testing at the filament insert gate with tube and water
 - Measured 0.25" pressure difference, which is equivalent to 0.01 psi.
- Pressure test to meet the safety factor of .02 psi (twice the actual pressure output)
 - Part held at 0.02 psi without dislodging



Complete seal necessary?

- Performed pressure test on canister.
 - When testing a canister solo, it was fully sealed.
 - When testing with the black metal inlet mating onto the canister, there were leaks between mating surfaces.
- Canister's mating surface is not flat: grooves and dents around opening
 - Not flushing with black metal inlet.
- Therefore, the cap doesn't have to be completely sealed.



Thermal Resistance

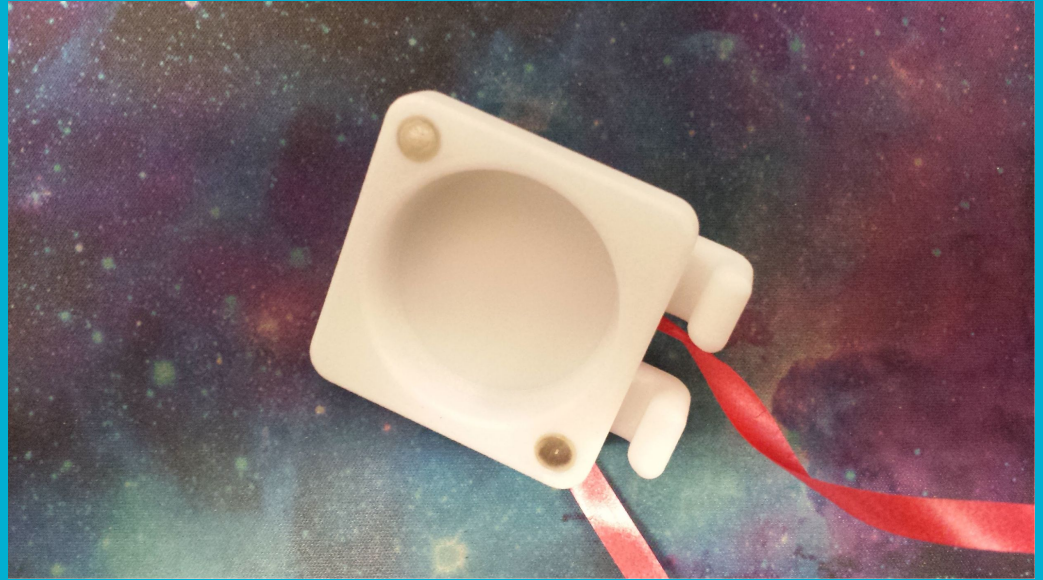
- Used a Digital thermometer to measure the metal plate that was attached to a machine which was printing Ultem at the moment.
 - FDM 400 - 33.5° C
 - FDM 900 - 35.5° C

Durability

- Drop Test: Held the cap at 3' height, then dropped 5 times.
 - Succeeded without damaging the cap.

Installation and Storage

- Chose Magnetic Concept: Easy Installation because the metal plates are magnetic. In addition, the doors are magnetic also. So, the material cap can be stored onto a door at a specific location.



Visibility

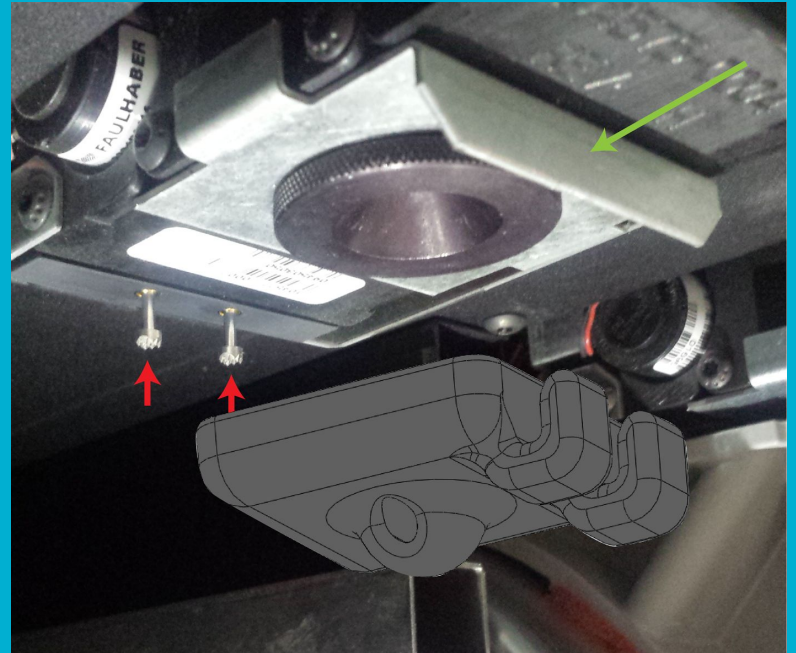
- The cap is visible when installed.
 - To avoid colliding with canisters.
 - Red ribbon attached to cap to signal that it is installed.
- Easy to find when stored
 - Vinyl (shadow of cap) sticker on the door?
 - Paint the cap red?

Magnet Interference with RFID

- Research data
 - According to online researches, It is not possible for magnets to interfere with RFID.
- Empirical data
 - Placed 2 prototypes (2nd iteration) with 1 cap per machine.
 - Tested on FDM 400 and 900.
 - Tested for 1 week
 - Pass

Magnet Interference with RFID

- Assurance that the cap won't hit the Transponder (red arrows)
 - 3rd iteration was designed
 - Mistake-proof implemented
 - Using the green arrow as a backstop



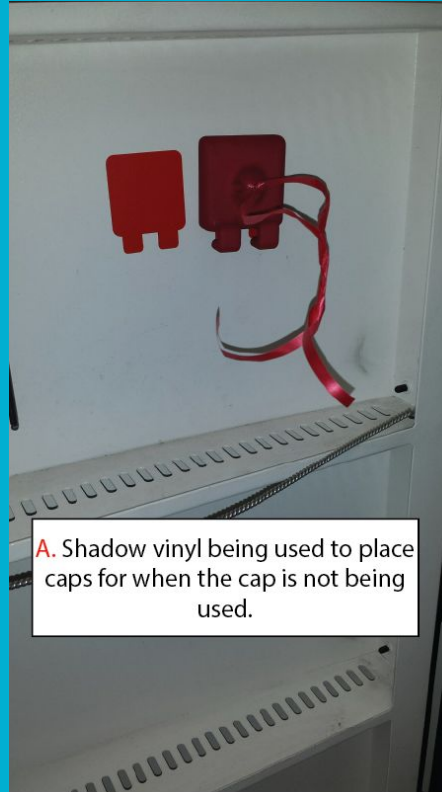
Production Phase

- Material
 - Nylon 12 PA
- SLS printing
 - 50 Caps
 - 22 machines total plus extras. 2 caps per machine.
 - Schedule
 - 5 days after ordering
 - Cost
 - About \$20 per piece, and 200 magnets for \$10
 - Total cost \$1010
- Post Processing
 - Sand Blast?
 - Dye (any preference?)

Questions or comments?

Thank you guys for your time.

Follow up: FDM Cap being in action.



A. Shadow vinyl being used to place caps for when the cap is not being used.



B. Cap is in action.