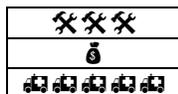


MAKING AN AIRLOCK STOPPER RETAINER USING A 3D PRINTER

V 1.00

Andy Tipler – 10/22/2020

RATINGS



PURPOSE

This project is to make a suitable retainer to stop stoppers holding airlocks from popping out of the mouth of carboys.

DESIGN REQUIREMENTS

This retainer should be compatible with all, or at least most, standard carboys, stoppers and airlocks.

The retainer should be easy to install and remove.

The retainer should prevent the stopper and airlock from escaping from the mouth of the carboy.

DESIGN APPROACH

The final design uses two plastic parts. The first part is a clip that locates around the neck of the carboy. The second is a plate that sits above the stopper. Extension springs are used between the two plastic parts to maintain pressure on the bung and keep it within the mouth of the carboy.

The two plastic parts which are shown in the first figure are produced using a 3D printer. It's difficult to envisage an alternative method of fabricating these.

The assembled device works very well and is very easy to install and remove. The second figure shows an example of the clip in action on a carboy.



CAD drawings of plastic parts



Assembled retainer clip holding a stopper and airlock in the mouth of a 3-gallon glass carboy.

MATERIALS

Only two materials are needed to build these clips.

3D Printer Filament

Probably any type of printer filament could be used to make these clips. I used PETG because it's fairly easy to print and has about the right flexibility to keep clip in place over the neck of the carboy. The most popular filament is PLA but this is probably a bit too brittle for making these clips. ABS could be used but it's more of a challenge to use. Choose the color you like best. I used white because it looked nice. A 1kg reel of this filament costs less than \$20 from Amazon and would be enough to make about 70 clip sets.



Extension Springs

A quick search of Ebay and Amazon revealed that buying suitable extension springs could be expensive. However, HarborFreight sells a kit of 200 springs for under \$5 (less if you have a coupon). I found that the best springs to use were 7/8" to 1" in length and 7/32" to 1/4" in diameter. This meant that at least 20 of the springs in this kit would be suitable for these clips. Three are needed for each clip.



TOOLS

To perform 3D printing at home, you are going to need a 3D printer and a computer. If you don't have this stuff, then town libraries and educational establishments may be able to help you. Failing that, you can send the print files to a commercial 3D print house – but they can be expensive. Refer to the section on the CheapskateHomebrewer.com website on 3D printing for more details.

3D Printer

Any 3D printer should be able to print these retainer parts.



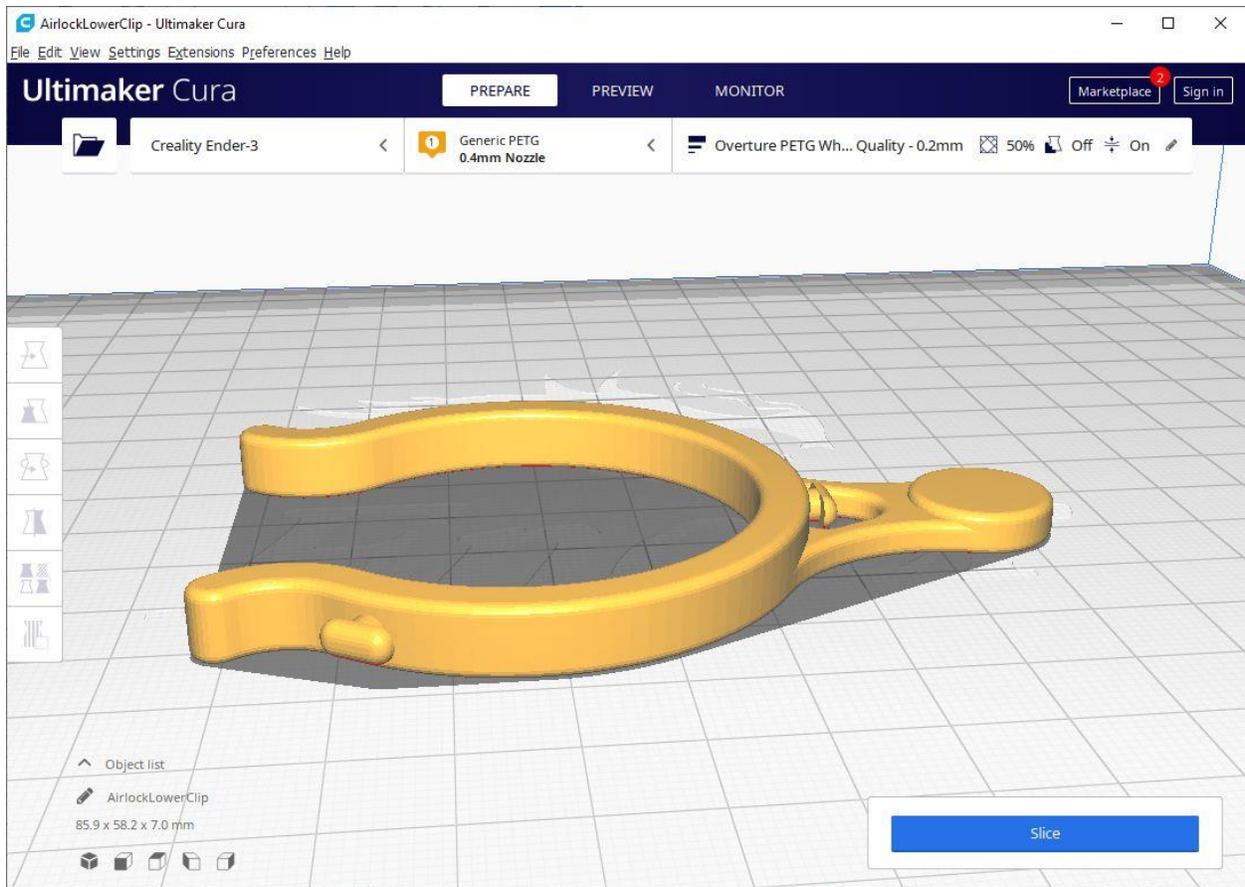
Computer

The supplied STL files in the download package contain the design of the retainer parts to be printed. These files need to be processed according to the model of 3D printer and the type of filament being used. The software that performs this processing is called slicer software. The output from the slicer software is a g-code file which is a list of instructions to direct the operation of a 3D printer to print the required part. Just about any PC or Mac should be suitable to run the slicer software. Many 3D printers need to be connected to the computer in order to upload the g-code data to be printed. Alternatively, the printer may have an SD-card or micro-SD-card slot to accept a card with the g-code files copied on to it (this is what I use). Obviously, a SD card slot or adapter will be needed on the computer to make these copies.



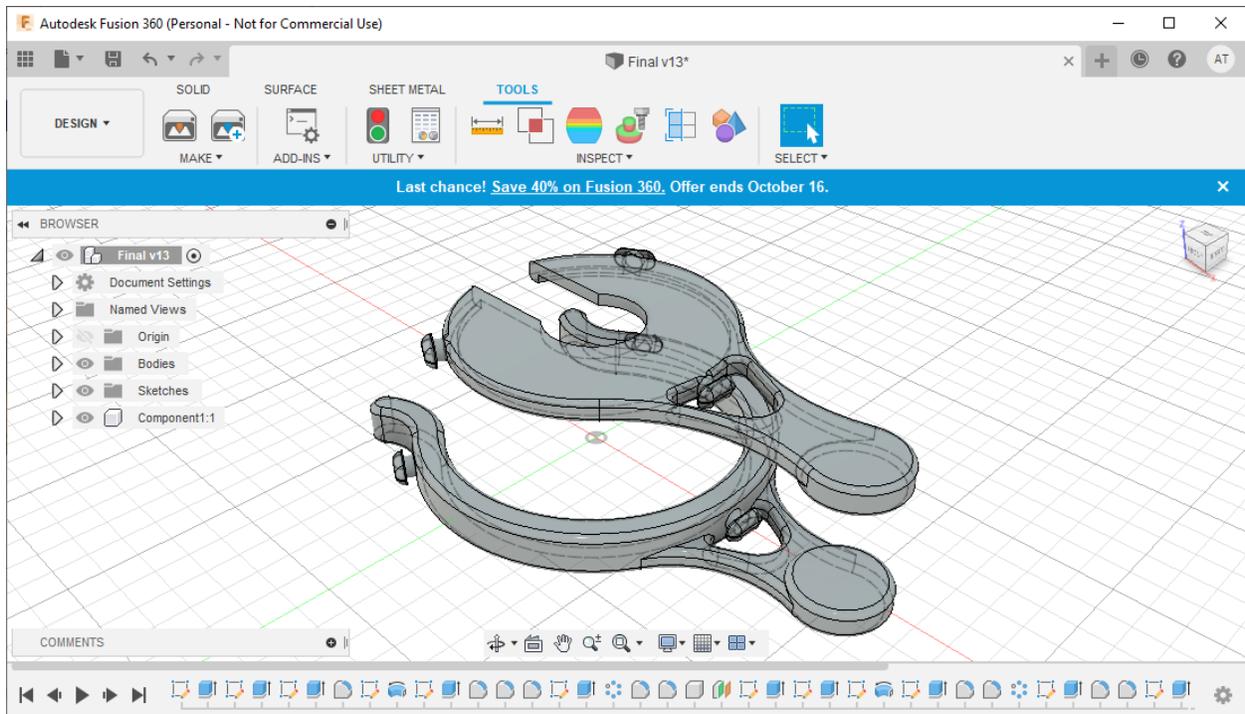
Slicer Software

There are a variety of slicer software packages available today. Most have to be paid for. One product that is free to use is [Ultimaker Cura](#). This is the slicing software I use, and I thoroughly recommend it.



CAD Software

The STL files included in the download package should be all you need to print these clips. However, if you need to change the design, these files are not very easy to modify and so it's usually better to modify the original CAD files and generate new STL files from them. The CAD software used to design these clips was [AutoDesk Fusion 360](#). This is a great CAD program and is free for personal use and I strongly recommend it. The Fusion 360 file is included in the download package with these instructions – if you need to change the design, modify it using the AutoDesk Fusion 360 software.



MAKING THE CLIPS

- Cura (or other slicing software) should be installed on the computer.
- Open the STL files for the retainer upper plate in Cura and check that the design looks right.
- The part will need to be inverted in Cura so that the top of the plate rests on the print surface shown in Cura.
- Check that the 3D printer model you are using has been configured in Cura.
- Enter the preferred settings for the filament. On my Ender 3 and Overture PETG filament, I used the primary settings in the table below. You may need to tweak these to suit your printer and filament.

3D Printer Settings

Nozzle	0.4mm brass
Nozzle temperature	235°C
Layer Height	0.2mm
Line Width	0.4mm
Bed temperature	80°C
Print speed	60mm/s
Supports	Enabled
Plate Adhesion	5mm Brim

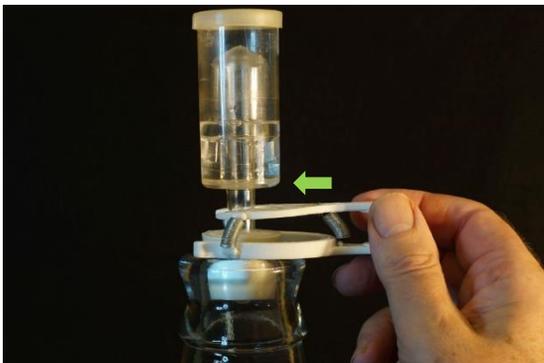
- Slice the design and transmit the resultant g-code file via a cable or SD card to the printer.
- Print the g-code file on the printer.
- After the first print is complete, load the STL file for the retainer lower clip into Cura and process and print that.
- Each print will take just over 1 hour to complete.
- Break off the brim and the printed supports below the spring cleats.
- With some very fine sandpaper, clean off any rough edges or surfaces on the two parts.
- Now fit the springs to the upper plate and lower clip cleats. This can be a bit tricky and you must be careful not to bend the spring wire or else the springs may not stay in place. I use a small screwdriver to push the spring loop over the cleat on the clip.
- Once all three springs are in place, the retainer is ready to use.



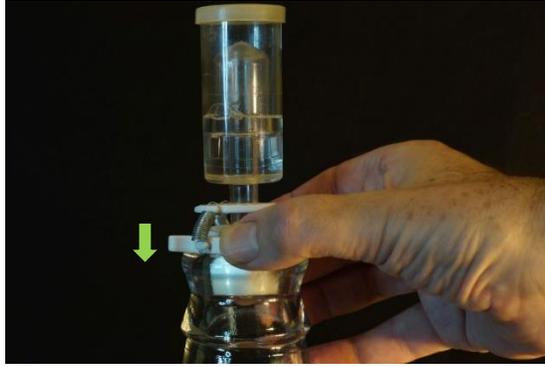
USING THE RETAINER

To Install

- Insert the sanitized stopper with the airlock already installed into the mouth of the carboy. If you're using something like StarSan, the stopper will probably immediately try and fall out, so you may need to hold it in place.
- Slide the retainer upper plate over the top of the stopper and around the neck of the airlock. The retainer lower clip should dangle loosely on the springs.



- Push the lower clip *downwards* over the lip of the carboy until it locates into the neck of the carboy.



- Your retainer is now installed.



To Remove

- Push the lower clip part upwards so it springs out above the lip of the carboy.
- Lift slightly and pull sideways the upper plate away from the stopper, the lower clip hanging by the springs will follow.



FINAL THOUGHTS

I have made several of these retainers and they are easy to use and work really well. I think they would make a good commercial product.

They make great presents for other homebrewers.

Good luck with this project. If you like the results, don't forget to leave feedback and a donation on the www.cheapskatehomebrewer.com website.