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Introduction

Look For The Helpers

The current global pandemic has spurred many people to search for ways to help support the overstretched medical system and many designs for personal protective equipment can now be found online, with examples ranging from 3D printed masks ( ), to replacement respirator parts ( ) and Venturi valves ( ), to DIY face shields ( ).

Prusa Research has released this open source face shield ( ) (adapted from this original design ( )) which anyone with access to the right tools can manufacture themselves.

In this guide, we'll show how you can make this design with a 3D printer and a 2 Liter PET bottle or two (3 L may work even better if you can get one!) in case you do not have a laser cutter or Cricut vinyl/craft cutter.

Why Face Shields?

Health-workers and other essential workers around the world are in need of face shields to help protect their eyes and face from droplets spread by the coughing and sneezing of their patients. Many are doing the best they can with what they can find ( ). In a time when normal supply chains may be disrupted, the open source community has an opportunity to step in and provide help to keep those who care for us.
As outlined in Prusa's blog post, these face shields do not suffer from the same downsides as 3D printed respirators which, due to the porosity of 3D printed materials combined with the humid environment of a wearer's face, can serve as a perfect breeding ground for bacteria and germs. Read on to learn how you can put your manufacturing capabilities to use helping protect folks in need of personal protective equipment.
3D Printing

Two-Part Design

There are two 3D printed parts to this face shield design, an upper piece which holds the shield a comfortable distance away from the face, and a bottom reinforcement piece which maintains the shield's curve along its length.

The source 3D files for this design were designed by Prusa for anyone to use and can be downloaded for free here.

This custom design was created using Fusion 360 and features user parameters for easily adjusting thickness, height, etc.

Suggested Print Settings

- 0.4mm Nozzle
- 0.2mm Layer Height
- 3 perimeters
- 30% Infill
- 80mm/s printing speed

This upper piece takes about 1.5hrs to print using the recommended print settings.

The bottom reinforcement takes about 20 minutes to print using the recommended print settings.
Face Shield

2D Files

The vector file for this face shield can be [downloaded for free from Prusa](#).

Files can also be downloaded by clicking the green button below and have been converted into a variety of different file formats (.dxf/.ai/.svg/.png) for ease of use.

Laser Cutting

[Clear PETG is recommended](#) for laser cutting these face shields due to its durability, flexibility, and transparency. It comes masked with removable film and can be ordered pre-cut to whatever dimensions best suit your laser cutter.
Hand Cutting

If a laser cutter is beyond your reach, it is also possible to hand-cut face shields from clear plastic. A 0.5 mm thick plastic is preferable, but you can use any clear plastic with similar thickness.

A couple of empty 2 liter bottles can be used in a pinch.
Face Shield Dimensions

The distance between the centers of each hole is shown in millimeters below. Holes can be cut as slight ovals to allow them to fit onto the holder more easily.

Tracing Guide

If you are hand-cutting your own clear shield, it can be very helpful to have a guide to make sure your holes are spaced appropriately.
Reference Design
Open the image file and make sure it is displayed on screen at actual size.

Turn up the screen brightness and grab a piece of paper.
Place a piece of normal printer paper over the screen and trace the position of the holes on the paper.

This paper can be used as a guide for where to puncture the plastic shield, ensuring the holes are in the correct spot.

Punch Holes

A standard office hole punch works well to create the necessary holes in the shield.

Holes can also be created by piercing the plastic with a sharp point and widening with a hobby knife.
Lengthening the Shield

A single two liter bottle isn't quite long enough to create a full face shield, so taping two together and trimming as necessary is recommended if you're creating your own by hand.

To provide full face coverage, ideally the mask should extend 240mm (9.4 inches) from top to bottom. Depending on the dimensions of the plastic you're using, you may need to lengthen the mask so that it provides full coverage.
It's important that these masks extend below the chin to provide adequate protection.
Vinyl Cutting

Transparency Film
There are other materials that can be used to create the clear plastic shield. Sheets of transparency film were used for testing purposes only.

Note: A minimum of 0.4mm for material thickness has been medically approved, only use thinner sheets for test fitting purposes.

Joining Sheets
These come in common paper sizes. These were 8.5in x 11in. The shield template requires a minimum size of 9.5 x 9.5in. Two sheets can be joined using packaging tape.

Taped Sheets
Apply a single strip of tape across two sheets. Add a second strip on top.
Sticky Mat
Position the transparency sheet onto the vinyl cutter sticky mat with the corner lined up and square.

Cutting Sheet
Use a material profile setting with a deep cut such as card stock, poster board or similar.

Knockout Holes
If the knife blade didn't cut through the two layers of tape, use a hobby knife to cut out the outline and holes.
Test Holes
Trim away any access tape. The sheet is ready for installation!

Installed Sheet
The holes have a nice and tight fit over both RC1 and RC2.

Bottom Holder
The three holes at the bottom also feature a nice and tight fit.

Assembly
For full assembly instructions please refer to this short video by Prusa () or allow permissions to view the video in-guide below.

The holes in the clear plastic piece should match up with the knobs on the headband. Start by connecting the face shield at one end and curving it around to hook onto each knob.
Press the bottom reinforcement piece onto the plastic shield by bracing the assembly against your body or something solid.
Elastic Options

An elastic band is required to hold the face shield firmly to the head. Hair elastics or rubber bands can be adapted for use with this design.

Tie loops in both ends of the elastic material and use the hooks on the shield to connect it.
Your face shield is ready to be tested!

Sterilization

Keep in mind: this design is meant only for personal use. Regardless of how you use it, sterilization remains important.

Keep your tools and work area clean, and use alcohol or soapy water to clean your parts before putting them to use.
Designing in Fusion 360

In this tutorial we're taking a look at modeling a protective face shield. We're using the design from Prusa Research and demonstrating how to design one with user parameters in Fusion 360.

Visor 3-Hole Design

Visor Face Shield
This design supports 3-hole punch system for use with sheets. Tested shield clearance with safety goggles and face mask.

Inspired by 3D Verksten design
https://www.youmagine.com/designs/protective-visor-by-3dverkstan

Prusa article on disinfecting face shields

Download CAD files from Prusa Printers

Download CAD files from Thingiverse

Download from Fusion 360
Visor features covered top and tight tension across 8.5x11in sheet.

Full 8.5x11in sheet is used with exception of trimming corners near chin area.

Curls on the ends of arm holds a rubber band. Arms are thin to minimize head coverage and use less material for faster print times.
3-Hole Punch
3-hole punch applied to both sides. Visor and bottom holder use same 3-hole punch (2 x 4.25in - 0.25in hole diameter).

Transparency Sheets
8.5x11in sheets of transparency film was used for test fitting.