

A slight variation on the Corsi-Rosenthal (CR) filter box

By Rex Allers 1/2023

Intro:

When I made my Corsi-Rosenthal filter box I made a few minor modifications to the original design. None of these changes are major but perhaps others might find them helpful.

First a quick list of the differences.

- 1. Tape** I used “Gaffer tape” rather than Duck (or Duct) tape. It is more like cloth and I prefer its adhesive. I have been disappointed with standard duck tape – as it ages it gets flakey and the glue can leave nasty residue on the taped thing.
- 2. Filters** Rather than the default 20x20” filters, I used 20x25”. It still uses the same 20x20 floor area but a bit taller. The taller size gives more filter area for increased flow. Also, time should be longer before filters get dirty and need replacement. At the time in 2021, the Corsi design created an unexpected demand for the 20x20 filters and the 20x25 seemed a little easier to find. Between box on-time the taller top surface can be a handy temporary table for moderately light items.
- 3. Different corner taping style** In the standard CR build, two filters are taped together to form a corner of the box. This is a lap joint, forming a fixed 90 degree corner. My change is to tape two filters together in a manor to form a hinge. In normal use the filters form the same kind of square box. But if one wants to move the CR box or store a number of them in minimal space, the box can be collapsed into a panel. It should be easier for moving/sharing to put several CR boxes into the back seat of a car with the filters collapsed this way. Details of this corner joint to follow.
- 4. Optional UVC Light** I purchased a UVC Germicidal lamp and put it in the center of my box. This should add another layer of protection to kill some virus. The main drawback is that this UVC light can damage eyes or sunburn skin with enough exposure. More discussion to follow below.

Building this version of the CR Box

The internet has many webpages and videos describing how to make a CR box. Please look for some of these other guides for more information. The CR box is a great effective way to build an air filter that should be effective to remove or largely reduce levels of virus, bacteria, or pollution such as fire smoke from an enclosed area (typically a room).

This design uses standard filters like furnace filters but these filters should be rated to filter very small particles like virus and bacteria. The filter used should be rated a minimum of MERV 13 which is equivalent to these other standards: MPR 1500 or FPR 10.

As mentioned above, the normal CR box uses 20x20” filters. I used 20x25” filters with the 20” widths making the 20” square rectangle to match the default 20” fan. My box is just a bit taller by the additional 5” from the 25” dimension of the filter.

My assembly of the box uses a different method of taping the filters together to make the corners of the box. In my method the corners form hinges. In normal use the corners are at right angles

forming the normal square shape of a CR box. But with the fan and top/ bottom layers removed, the filter section can be closed to form a flat rectangle with a thickness of two filters.

Assembling Hinged Filter Box

The pictures I took could be better but this section will attempt to describe my method of taping the filters to make a hinged, collapsible box.

First, here is the Gaffer tape I used.



The Gaffer tape is more cloth-like than normal duck tape. I also think the adhesive used is cleaner. I bought a few rolls of 2" x 100 ft black. The 2" seems good for this. One roll was much more than what was needed for one box with my longer filters.

Here are two of the four filters for my box.



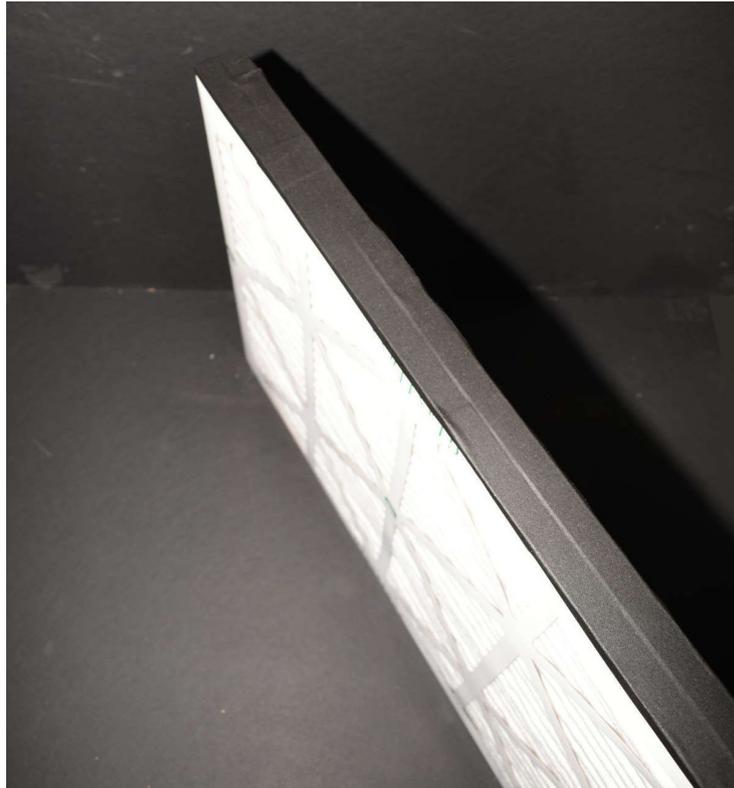
It can be seen that they are rectangular, a bit taller than the 20" width.

To begin I placed two filters together this way.



Note that the filters are arranged so the air flow arrows on the filters point from the outside inward. I have temporarily placed two small tape strips on the narrower 20" width of the filters to hold them aligned. Additional temporary strips can be added to what is currently the bottom in this picture.

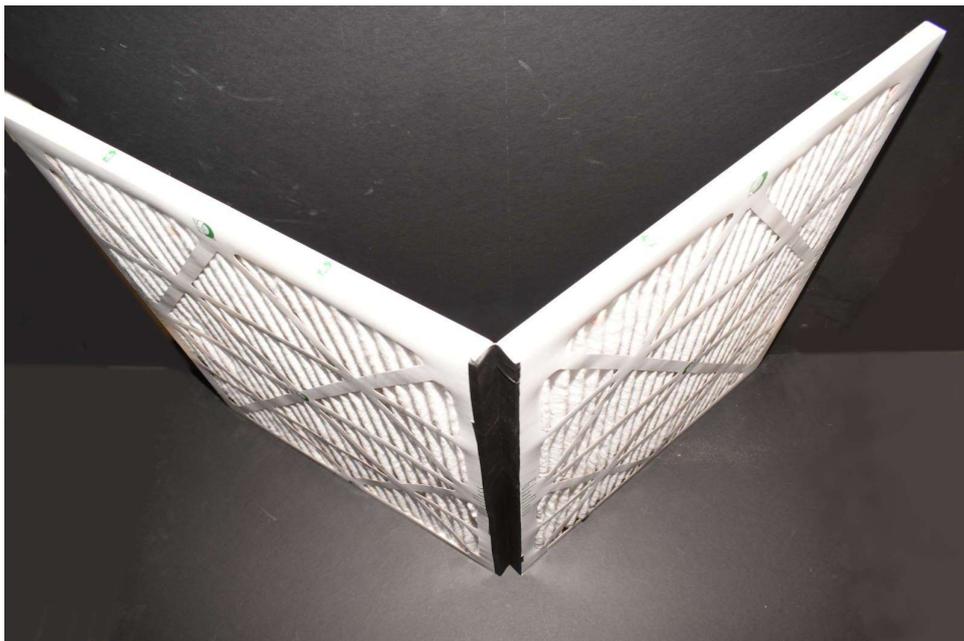
Now on this pair we permanently tape just one edge.



This is taped to join across just one long edge of the pair. The tape length can overlap a bit while taping. Afterward a sharp knife can be used to trim any excess tape beyond the filter end.

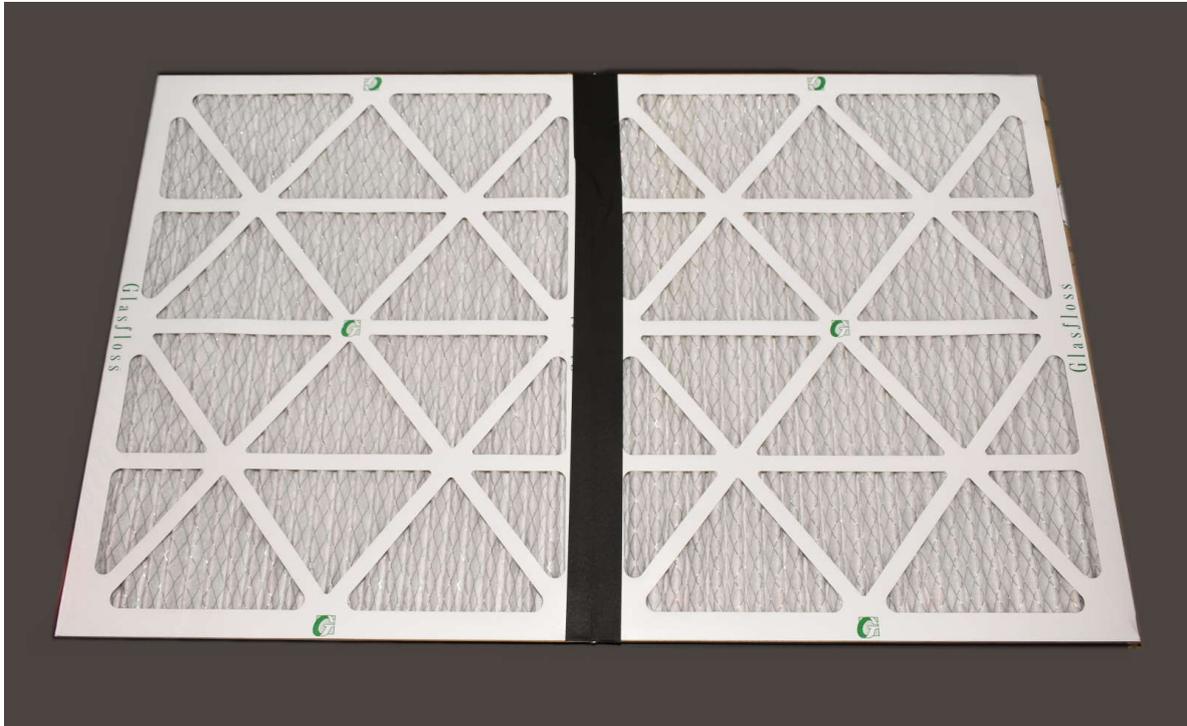
Then the temporary tape pieces are removed, which lets us...

We open up the two filters using the tape strip as a hinge.



Then continue to open and lay the filters flat with the hinged corner of the two filters upright. Squish the two filters together to be sure the taped ends are brought as tight together as possible.

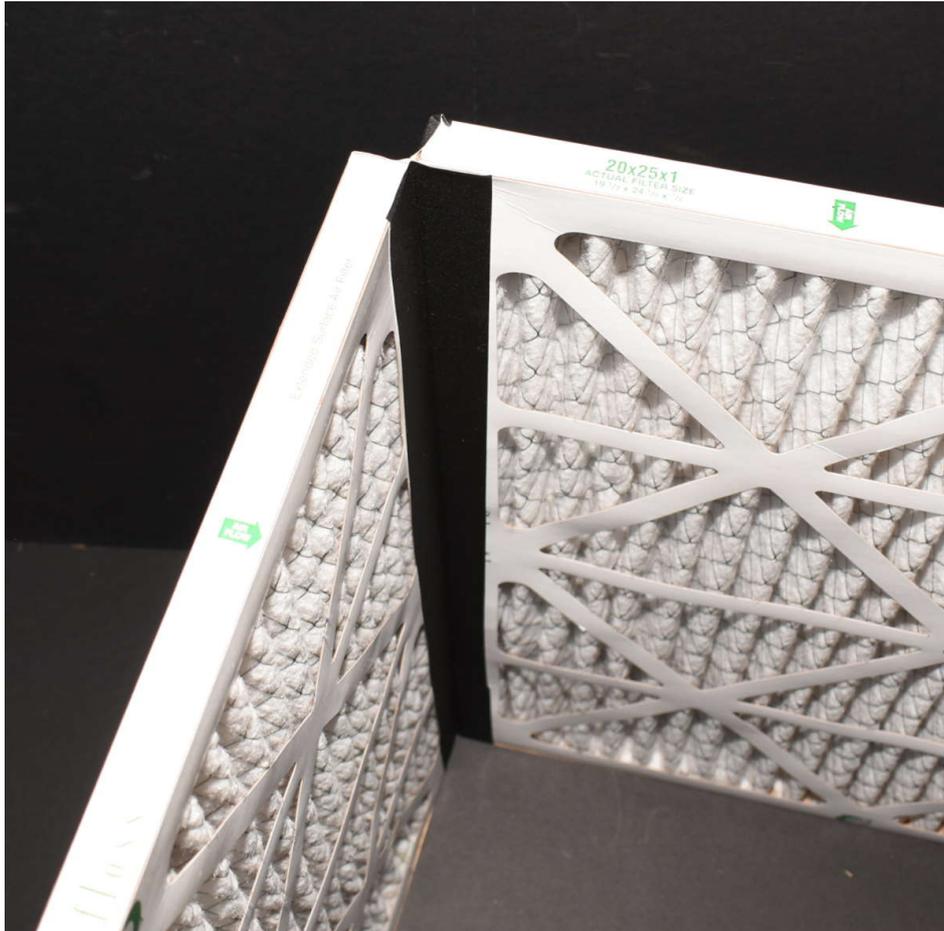
Then...



Apply a strip of tape down the hinged joint to make an opposite hinge layer. (As shown completed above.)

At this point we can lift the pair of filters and fold them.

Here is the hinge folded square, with the last applied tape strip facing us. The first applied tape strip is not visible but forms the back side of this hinge.



– Now, the next step is to repeat this process in the same way using the other two filters. Be sure to repeat the same orientation of the air flow arrows.

– When that is complete you have two pairs of filters, each hinged in the middle. Open them up straight and place them together. Be sure the air flow arrows point inward toward the other filter pair.

– Now with these two filter pairs aligned together (you can add temporary holding tape strips if desired) tape just one edge of the doubled pair as was done on the first taping of two filters.

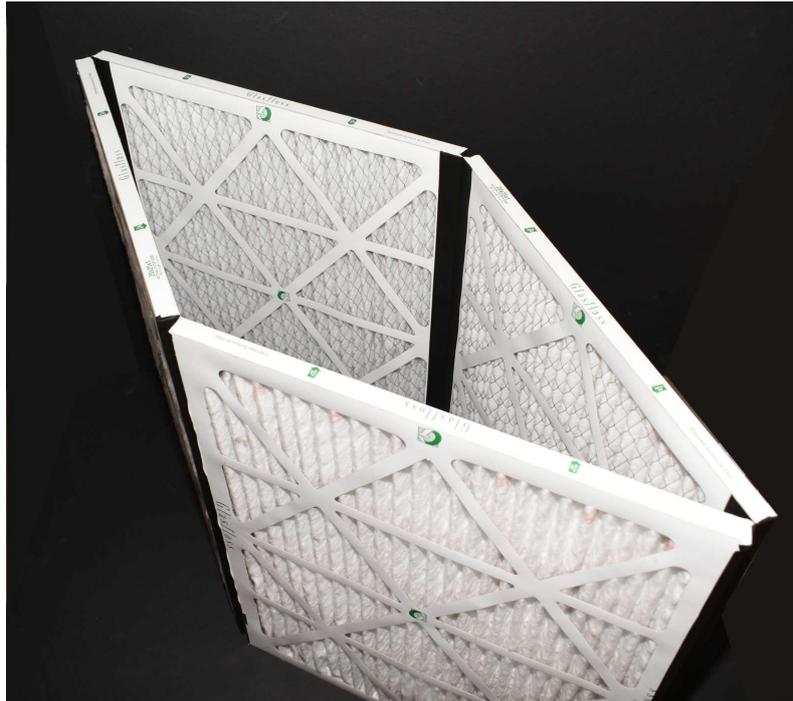
– Open up this new third hinge and tape its inside as was done in the first hinge to make a complete third hinge.

Now close this hinge to align the two pairs of filters as they were before, at the beginning of the taping of this third hinge. The two remaining untaped filter ends should be together, opposite from the newly created third hinge.

– Now tape this outside edge of the remaining untaped filters to create the outside portion of the fourth hinge connection.

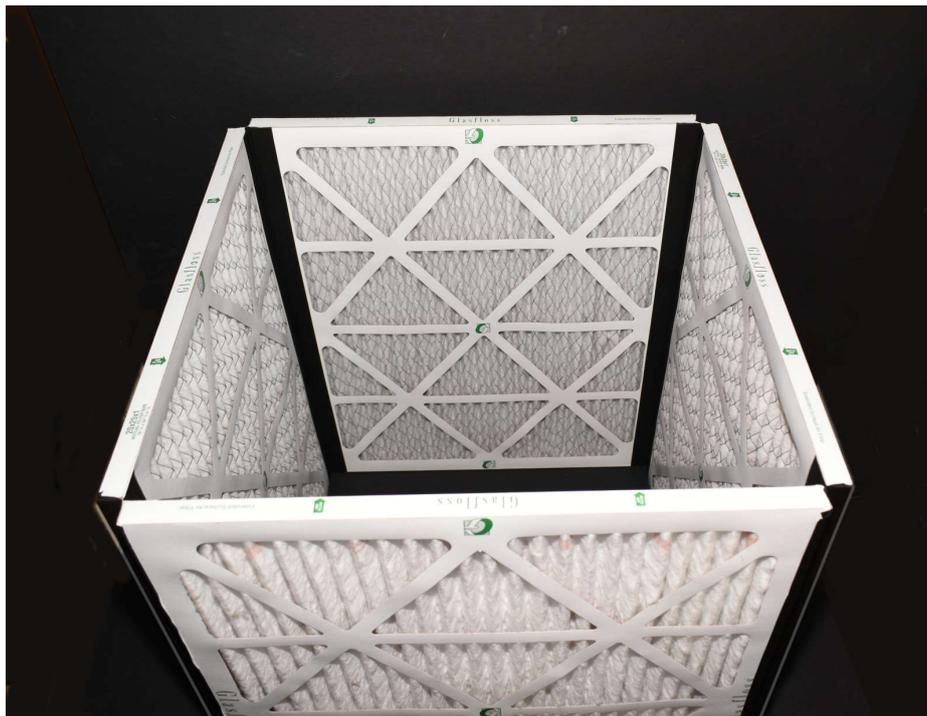
The inner side of this new fourth hinge can't be exposed for easy taping, as was done in the other three hinges, because it is now on the inside of a closed trapezoid formed by connecting all the four filters.

The now almost fully hinged box can be opened or partially collapsed as shown here.

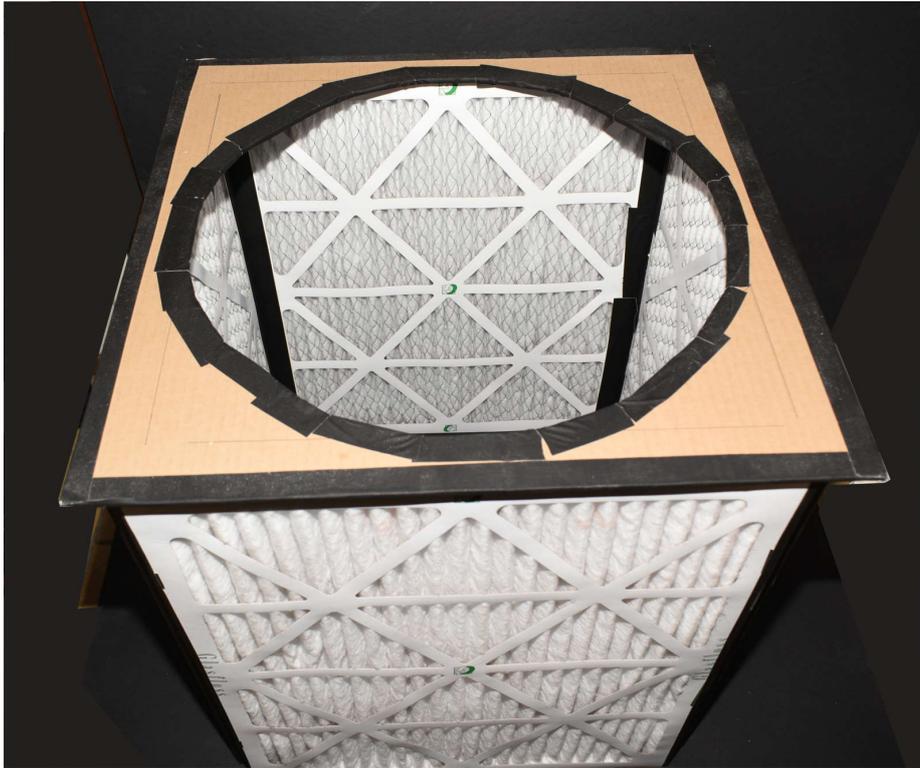


If we arrange the last incomplete hinge so that it is positioned like the left-center hinge in the image we have enough access to apply tape to the inner side of that hinge. The method I used was to cut a shorter section of tape and apply it to fill the top inner section. Then invert the whole filter assembly and add another shorter inner section of tape. Depending on the length these last two tapes, possibly a third short tape for the center of this inner hinge taping.

When all four corner hinges are complete the functional CR box arrangement will be aligned into a square shape like this.



If we add a top layer with a circular cut-out in the diameter of the fan blade, as recommended in other CR box guides, it would look like this.



Note that I added tape around the cardboard edges just as an attempt to keep them from fraying. This is not necessary.

The box should work well. The change in the hinge taping arrangement allows the pieces to be separated (Fan, Top baffle, filter box, bottom) and then squishing the filter into a flat sheet. Note: if the floor is flat, there really doesn't need to be a bottom.

To the reason for my hinge changes, when separated, the box filters can be collapsed to a flat rectangle for easier movement or storage.

Adding UVC

As part of my early 2021 Covid defense I bought a couple of UVC Germicidal Lamps.

UVC kills bacteria and probably viruses. Some debate about Covid but my take is that in a UVC exposure of short duration, like an air stream it might not get a high percentage reduction. But I never heard the UVC couldn't kill virus with enough exposure.

The bad news on UVC (the germicidal wavelengths of UV) can damage eyes or burn the skin.

In the beginning of Covid I had bought a couple of UVC lamps rated at ~36 W output. The plan was use them in rooms when nobody was around. No eye or skin issues if nobody there.

The following CR box addition is optional:

After I built my Corsi box it occurred to me that one of the UVC lamps would fit inside of my filter box. The UVC lamp had an RF remote (not IR) so I could control it while placed inside the box. That type of remote is important if put inside the CR box.

So I periodically turn on the UVC lamp from time to time. The remote can select to start an on time of 15, 30 or 60 minutes.

One idea is that if the filters work they will have bad stuff trapped in their fibers. Running the UVC from time to time might cleanse the filter fibers.

When the UVC lamp is on there is a blue/violet illumination visible on the filter surfaces. No doubt this is reduced from the lamp level. Is this filter glow a safe level for eyes, etc.? When lamp is on I try to avoid any direct view path for light coming through and visible on the filter faces.

I think it is worth using this lamp from time to time as an extra degree of cleaning for the filters.

It may also improve on the already good filter efficiency. In higher danger (people visiting / increased potential virus exposure) it may help to turn UVC on. But I recommend to have a way to block any direct UVC exit exposure so any people can't see the UV glow. In one case I have leaned a large paper board sheet against the box so it blocks any light but is skewed to let air into the filters.

UVC what I bought

The lamp I bought in 2021 is no longer available. It was rated as 36 W
height was about 17.5 inches
base diameter about 8 inches.



Today 1/30/23 my ebay searching finds similar UVC Germicidal lamps, now rated as 60 W, \$37 with free shipping.

I also see many expensive listings ~\$100 ish – so be careful if buying one.

Adding this pic of my UVC lamp put into the center of the CR box as an addition to improving virus mitigation or filter cleansing.



Sound Noise

Some people or applications seem to have a problem with noise from the standard CR box 20" fan.

A common Lasko fan is all I have ever used. Some current ideas to use PC fans sound reasonable. But I don't think the Lasko fan noise is excessive.

I measured sound levels at about 3 feet from my Lasko fan.

Speed vs dB

L 51

M 57

H 61

So from the internet I find:

50 dB is around a normal home background

60 dB is a normal conversation

So consider getting quieter fans if you are really sensitive.

I normally set my fan on Low for long general filtering.

If I think something justifies setting High for a while – it might be noticeable vs. a quiet room.

So far I'm good with the Lasko fan.