

# How to build a Do-It-Yourself Fan/Filter Air Cleaner

using a 20-inch Box Fan and a high efficiency air filter

Build one for ~ \$40 and to clean the air in a small to medium sized closed room.



A simple system for healthier air!

Do use a newer fan (~2012 or after) with a **fused plug** + safety label on the cord. This does **not** mean 3-prong plug but just a larger plug than the older models! All new fans should have this!

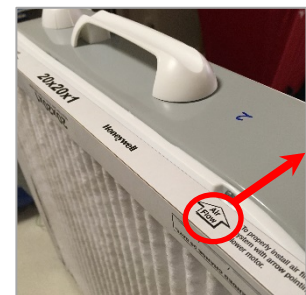


## MATERIALS:

- 1 – 20” Box Fan
- 1 - 20” x 20” MERV 11 to MERV 13 electrostatic air filter
- Tape or bungee cord to hold the filter in place

## ASSEMBLY:

1. Follow the manufacturer’s instructions to assemble the Box Fan.
2. Place the filter on the back of the fan with the airflow arrow pointing towards the fan. **When the fan is turned on it should pull air through the filter.**
3. Secure the filter with tape or a bungee. Use masking or duct tape. Write the date when the filter is first used on the filter or tape.



**WARNING:** Box fans – if an older model or used incorrectly – can ignite and start a house fire. The most common cause of fires is the motor locking up under load and overheating. You can prevent this if you:

- Use a newer fan equipped with a **fused plug**
- Keep the **fan and motor clean** (lint and dirt can cause overheating and catch on fire)
- Keep **curtains and loose clothing away** from the fan. If the fan does not start quickly and run smoothly do not use it.

Now you know the risks! We tested several brands of new box fans with filters attached, as described here, and found them to operate at or below their maximum design operating temperature when they are clean and well-maintained.



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## A few more details more worth knowing

Hoping to give folks an affordable DIY option to clean indoor air, especially during wildfire smoke season, we worked with a mechanical engineer to ensure these are safe!

### What we have learned from our research and testing:

PM2.5 and ultrafine particles can be removed from the air with a DIY Room Air Cleaner. It is most effective with **new electrostatic filters** having a MERV 11 to MERV 13 filter rating. Equivalent ratings are FPR 10 and higher and MPR 1500 and higher.

Change the filter when it changes color to gray or at the filter manufacturer's recommended time. **New electrostatic filters** work best for the really small particles that are the most harmful to breath. One filter testing company recommended changing the filter every two weeks for best ultrafine particle capture.

A DIY-Air Cleaner with a new filter is about as effective as a small or medium sized commercial room air purifier, with a comparable Clean Air Delivery Rate (CADR) based on airflow and the E1 (0.3 to 1 micron particle size) efficiency.

The fan motor life is rated for 20,000 hours of continuous operation (24/7) in a room with 104°F ambient temperature. As the air temperature nears 100 °F the motor may stop working because the motor is over the safety cutout temperature, this may happen at a lower air temperature if the motor not clean, worn or damaged. Using older box fans is not recommended as they are more likely to catch fire (those built before 2012 may not be safe!).

**REMEMBER: The more it runs the cleaner the air**

### Abbreviations:

- **CADR** – Clean Air Delivery Rate, an air purifier rating system from the Association of Home Appliance Manufactures. It is an indication of how much filtered air comes from an air purification system.
- **E1 efficiency**- The ratio of entering and leaving particles, 0.3 to 1 micron in size, through a filter (Part of the MERV rating system).
- **FPR** – Filter Performance Rating, a Home Depot filter rating system
- **MERV**- Minimum Efficiency Reporting Value, a filter rating system that uses the minimum tested particle removal efficiency for filter comparisons. Developed by the American Society of Heating, Refrigeration and Air Conditioning Engineers.
- **MPR**- Micro-particle Performance Rating, developed by 3M for rating the capture of particles 0.3 to 1 microns in size.
- **PM2.5**- Particulate Material in the air that is 2.5 microns or less in size.

**For more information go to [montanawildfiresmoke.org](http://montanawildfiresmoke.org) or  
[missoulaclimate.org/summer-smart.html](http://missoulaclimate.org/summer-smart.html)**