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Whole-House HEPA Filtration

Awareness of how important air quality is to human health has grown in our industry, as well as in society at large. The COVID-19 virus invigorated sales of household air cleaners, and the abbreviation IAQ became as ubiquitous in conversations as NFL, ROI, and, for builders, CYA. Innovations like the Comparetto Cube (five filters and a box fan) and the Corsi-Rosenthal box (just four filters) were offset in the marketplace by opportunists putting a computer fan behind a filter media in a sleek housing and offering it for sale online. While some of those devices did offer some benefit, many of the air cleaners dropped off on front porches by masked Amazon drivers were boxes of "snake oil" with little hope of providing improved health outcomes for their owners, as referenced in articles by Allison Bailes and others trying to save consumers from a bad purchase.

In terms of function, air cleaners are simple machines and typically have just two key elements: a fan and a filter. Like a miniature forced-air furnace without any heating (or cooling), they simply pull air into a housing and push it back out through a filter to capture some level of particulate—nothing more. The level of filtration varies by unit but like any range hood or bath fan, these small units can filter the air in a localized area only. The limitation on the volume they clean or "scrub" is a function of their size (filter surface area with fan strength) and location (the air they can access).

The typical interior of a home allows for communication of air from one room to the next through hallways and under and around closed doors, and from one floor to another. But despite these pathways, most existing homes have relatively little air circulation without the use of central air handlers and distribution ductwork. As a result, these tiny, localized air scrubbers have limited reach, and unlike with a Corsi-Rosenthal Box, which has a larger filter surface area and decent airflow, you need multiple units to handle multiple rooms.

In theory, you could set the fan in an existing, centrally ducted air handler to run continuously to circulate air to these individual filtered locations. But in recent years, we've shifted away from recommending continuous operation of the air handler, as this can lead to high humidity, especially in tighter, better insulated homes, which call for less cooling and therefore less dehumidification of the constantly circulated air. Also, hoping that the air circulated to these spaces will efficiently find its way to these air scrubbers for cleaning and redistribution throughout the house is too optimistic. Eventually, the air should in theory find the filter, but the volume of air flowing through the filter devices is fixed, and many units don't separate their supply and return by more than a few inches, so they may scrub the same air over and over without cleaning the dirtier air that can't get in the mix.

A wide variety of small filter fans **(1–3)** have inundated the consumer market. Most of these have too small a filter area and too little airflow to effectively clean indoor air except in small, localized areas of a home.

The Fantech Hero HS300 **(4, 5)** offers "3 stage filtration," which includes a carbon prefilter that reportedly captures 90% of particles between 3 to 10 microns, as well as a HEPA filter to capture 99.97% of particles .3 microns and larger. As an alternative to being integrated with an existing air handler (see images on facing page), the unit can be installed as a stand-alone unit in an attic or basement with 8-inch supply and return ducts to serve the main living space.

Rather than rely on small, room-by-room, plug-in units, we favor installing a whole-house HEPA filtration system, specifically the Fantech Hero HS300 appliance. Fantech boasts "3 stage filtration," citing a prefilter with carbon capturing 90% of particles between 3 and 10 microns and a HEPA filter to capture 99.97% of particles .3 microns and larger. This unit has two speed settings—220 and 300 cfm—and though it operates independently from the air handler, it uses the existing ductwork system to access the entire volume of the household air for constant filtration. It's an insulated box with an inlet at the top, a prefilter with carbon, then the fan, the HEPA filter, and outlet at the bottom. For us, the insulation is primarily for sound control since the unit isn't heating or cooling the air, though it also would allow for installation in an unconditioned space.

The Hero requires a 120-volt receptacle but draws only 1.23 amps under constant 300-cfm operation, so it doesn't need a dedicated circuit. In conversations with Fantech, I was told it can effectively treat spaces up to 3,000 square feet in a matter of hours, but that obviously would depend on the ductwork design and other factors in the home.

INSTALLATION OPTIONS

There are two methods for installing a Hero with forced-air duct systems, and we've used them both, for different mechanical room sizes. The fast and simple way involves cutting two rectangular openings on the side of the vertical return duct before it turns and enters the air handler. The back of the Hero has two corresponding ports, the top inlet and the bottom outlet, which have heavy-gauge-metal tabs that fold out and wrap into the rectangular openings you cut—pretty elementary metal work that requires only a pair of good snips, gloves, and, if you're fancy, a nice set of hand seamers to dress up and reinforce the openings. Gasket material is provided for sealing the back of the unit to the ductwork, and the folded metal is backed up with screws to secure the installation. Fantech recommends this installation method along with having the fan on the air handler set to run continuously to maximize filtration and to eliminate the possibility of the air short cycling. We find this approach works great for small mechanical rooms that can't accommodate the additional ductwork required for our preferred installation method, which provides more separation between intake and discharge.

When an existing air handler is used, the simplest way to mount the Fantech HS300 is on the side of the vertical return duct before it turns and enters the air handler **(6)**. Alternatively, knockouts in the filter's housing allow the unit to be mounted farther from the air handler using 8-inch flexible ducts **(7)**. This not only gets it out of the way but also helps limit sound transfer.

This second, preferred method makes use of a couple of 8-inch round knockouts—one at the top and one at the bottom of the unit—to connect the Hero to the return via collars and ductwork. This gives us flexibility to locate the unit farther from the air handler and potentially more out of the way, as well as limiting sound transfer from the already very quiet fan. By pulling the 8-inch inlet farther up the return trunk and discharging the filtered air through a separate 8-inch line into the return just before it enters the air handler, we believe we are eliminating any potential for short cycling even if the occupant turns off the continuous operation setting on the air-handler fan. There's little discernible noise from the Hero's fan thanks to the robust gaskets and heavy rubber insulation on the filter and fan access door, but the inside of the unit obviously is open to the air duct, so the low-level sound from the fan does travel into the ducts and communicate throughout the house. Locating the appliance remotely rather than hanging it from the return duct prevents the sound vibration from transferring into the duct, and installing flex duct from the Hero further reduces the sound.

In addition to the methods above that use the existing ductwork and air handler, a "stand alone system" option in the Fantech instructions allows the unit to be mounted in a basement or attic with dedicated 8-inch supply and return ducts to serve localized areas.

If mounted in an attic, the unit must run continuously to prevent condensation in the ductwork at temperatures below freezing. Reportedly maintenance free and "permanently lubricated," the motors are guaranteed for seven years, and the remaining components for five years. Recommendations are to change the prefilter every three to six months and the HEPA filter every two to five years. We typically leave homeowners with a replacement prefilter on install and suggest they order new replacements for both filters when they need to install the prefilter we supplied. Available for about $450 online, these Fantech HS300 Hero whole-house HEPA filtration units are more expensive than a Corsi-Rosenthal box but much quieter and far more aesthetically pleasing. I believe that with the integration with the ductwork in our clients' homes, they are an extremely effective solution to filtration, and we're making them as standard in our homes as ERVs and dedicated dehumidifiers.

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