PARTICLES PLUS®

Show Number: 713

Jim Rosenthal

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Air Cleaning, Filtration and the Corsi-Rosenthal Box

Good Day and welcome to the IAQ Radio+ episode 713 blog. This week we welcomed Jim Rosenthal to talk about air cleaners, filtration and the Corsi-Rosenthal Box. Jim not only knows a lot about air cleaners and filtration his company makes filters and more.

Jim Rosenthal is the Chairman and Chief Executive Officer of Tex-Air Filters. He has over 20 years of experience in the air filtration and environmental control industries and has been active in the National Air Filtration Association (NAFA) – serving as its President in 2009-2010. He is a Certified Air Filter Specialist (CAFS) by NAFA. He was President of the Asthma and Allergy Foundation of America –Texas Chapter from 1998 to 2013. He is also involved in air filter test standards and is currently a voting member of the ASHRAE 52.2 Committee.

Nuggets mined from today's show:

Please tell our audience about your background and your position with Tex-Air Filters? After finishing university, Jim worked for others while always wanting to go into business himself. Jim's entre into business was in the retail sale of allergy and air cleaning products. This morphed into air filter manufacturing. Greater awareness in the value of air filtration resulted in an uptick in business during Covid. During Covid, Jim's company fabricated and gave away 25K facemasks.

How are air filters tested? Air filters are tested using the prescribed procedure of American Home Appliance Manufacturers, Clean Air Delivery Rate (CADR) standard. Filters are tested against three substances: smoke, dust & pollen. The test results are represented by 3 individual numbers which allows filters and air cleaners to be compared to others.

- The ASHRAE 52.2 ANSI/ASHRAE Standard 52.2-2017 Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size

Why MERV 13 Filters? MERV 13 filters are air filtration's sweet spot. Brent Stephens' did a virus removal study using the Wells Riley equation. MERV 13 is the cutoff for removal. Pleated filters with their added filter media are the predominate filter type sold in North America. Pleated filters are not nearly as popular elsewhere.

What other factors beyond filter efficiency are important in air cleaners? Filter, fit and flow and replacement intervals.

Should we be worried about captured particulate escaping from filters? While theoretically possible, there is no data supporting infectious particle escape from pleated filters. Forensic filter analysis was and is being done. Viruses need moisture and a protein shell to survive. Moisture movement across filters speeds evaporation and desiccates microbes.

The Corsi Rosenthal Box, how did the story begin? Jim was contacted by a reporter from Wired Magazine who queried him about his opinions "janky" air cleaners made by attaching filters directly to fans. Jim then began experimenting with DIY air cleaners by attaching multiple air filters to fans to reduce pressure drops. Jim finds building things therapeutic and stress-relieving. Don Milton of University of Maryland recommended the CR boxes be used (also suggested the name) at the Vice-Presidential debate and the NY Times picked up the story. When Rich Corsi was asked about the "Corsi Box", he set the record straight by crediting Jim. Since then, the devices have been known as the Corsi Rosenthal Box.

Jim and Rich wanted to share their ideas and experiments and made the boxes open source. Between 200,000-250,00 have been built globally. They receive continuous feedback. The boxes have been studied and found to be highly effective. Footprint size and noise are considerations to some people and in some places. Box fans are replaced by multiples of computer cooling fans, reduces noise, energy consumption and footprint.

Collateral benefit is that building the CR boxes in schools has raised awareness of the importance of IAQ, provided leadership and organizational opportunities for leading groups in assembly of the units.

Corsi-Rosenthal Foundation. To keep the momentum going and to make effective low cost air cleaners available to everyone, Jim and Rich started the Corsi-Rosenthal foundation. A 501 (c) 3 nonprofit organization dedicated to providing cleaner and safer indoor air for all. Our emphasis is on schools, shelters, churches and other indoor spaces where people gather and need the benefits of indoor air quality at a moderate cost.

Rather than having 1 large filter in the air handler, could filters be placed on the return registers? Jim opined that ductwork isn't sized to accommodate individual filters and that placing filters on the registers would result in excessive pressure drop.

What advancements have been made since the original design? Addition of the shroud on box fans increase efficiency by eliminating negative airflow in corners. The shroud improves efficiency 30%-40% improving positive airflow to almost 100%. Use of modular computer fans. Many other improvements have been the result of many heads rather than only 1.

What kind of testing has been performed on the CR box and how does it stack up to commercially available air cleaners? You need to move air, to clean air. Tests by: UC Davis, UConn, NIOSH/CDC and EPA have proven the effectiveness and superiority of

- In testing Jim did in house a MERV 11 CR box outperformed a commercial HEPA air cleaner.
- Cleanrooms rely heavily on air changes to remove particles. For example ISO 7 cleanrooms class 10,000 have 60 ACHS, while other buildings and facilities are happy with 6-12 ACHs. Jim was able to achieve ISO 7 cleanroom class 10,000 particle levels using 2 CR boxes.

Where should C-R boxes be placed in rooms? How many C-R boxes is optimal in a 600 to 1000 square foot school classroom? Occupancy is a consideration. CR boxes placed 3' away from walls achieve similar results. 2-3 units are recommended for a

600-1000 sq ft classroom – this should achieve 5-6 ACH. Just remember Distribute-Dilute-Remove Particles.

Are you concerned about the safety of CR Boxes due to fans overheating?
Approximately 200,000 and growing CR boxes are in use globally; and incidents of overheating are unknown. The EPA commissioned UL to study CR box overheating. UL found that even when the fan was totally blocked, it still passed the UL test. Many fans have a fuse in the plug.

Z-Man questions:

The East Palestine train wreck is 30 miles from Pittsburgh, we received calls from residents concerned about chemical contaminates what would you recommend?
CR boxes can be made with carbon containing filter media. Carbon is not universally adsorbent; carbon is more effective on some chemicals than others. It would be good to know the target chemicals. Adsorption of airborne chemicals and gases requires enough carbon. Frequent carbon filter changes would be needed.

Wildfires? The EPA studied the use of a variety of air cleaners following wildfires and found that the CR box did the best job. Brown University found that the CR box effectively trapped phthalates and Perfluoroalkoxy alkanes (PFAs).

Bioterrorism? Bioterrorism is particles. CR boxes are highly efficient in particle removal.

ROUNDUP

CR box using two, 3 fan computer (6 total fans) cooling modules with 16”x20” filters operate at approximately 300cfm.

HVAC filters only remove particles when the blower is running.

Mini split units have poor filtration. If you have mini split, you need a CR box.

Filter thickness:

- 2” filters predominate commercial applications.
- 1” filters predominate residential applications.

- If you want to improve filtration in a residence, install a 4” filter.

ASHRAE 241? ASHRAE 241 is revolutionary, it was completed in record time. By and large it is a great standard to control infectious aerosols. Appendix J. MERV A and ISO 1690 are poor filter recommendations. 80%-90% of America will be unable to comply as MERV-11a to 13a pleated filters are not readily available. He is concerned that is they can’t comply and they will choose less effective filters.

Z-Man signing off

Trivia
Name the standard developed by AHAM in the 1980s to measure performance of air purifying devices?
Answer: Clean Air Delivery Rate
Answered by: John Corliss