IMPROVING A HOME'S IAQ

Looking beyond high MERV filters

By Linda Wigington and Rhett Major

High minimum efficiency reporting value (MERV) filters installed in air handlers with sufficient run-time can provide significant filtration benefits, removing fine particles from indoor air. However, this level of filtration may come with significant costs, both in fan and building energy costs and HVAC system performance.

The Pittsburgh-based **Reducing Outdoor Contaminants in Indoor Spaces (ROCIS*)** initiative launched the **Low Cost Monitoring Project** in 2015 to determine whether these systems, used with a high MERV filter and other interventions, could reduce household particle levels and improve indoor air quality while cutting costs.

To date, more than 40 systems have been tested through the **ROCIS Air Handler Inquiry**. The vast majority of the systems had existing problems, such as:

1 At installation, airflow had not been adjusted in-field, and, as a result, the default airflow was too high for optimum heating and cooling. In addition, the systems defaulted to a high airflow if set to run continuously.

2 Watt-draw was widely variable and higher than expected for both permanent split capacitor (PSC) and electronically commutated motors (ECM). For one exception, the range was 350–1500 watts for heating and cooling fan flow. In most cases, the cost of running the air handler 24/7 was more than $60/month.

3 More than 75% of the systems tested had Total External Static Pressure (TESP) much higher than the manufacturer's recommendation; many had restrictions on the return air side. Clogged coils and high static across the filter were also common.

4 One-inch, high-performance filters were very restrictive, particularly when dirty, and got dirty quickly (in less than a month).

To address these issues, the best solution was the replacement of the return drop with a larger one. The new return air drop improved the aerodynamics by eliminating hard 90s and/or the installation of turning vanes. A horizontal filter slot was incorporated in the middle of the drop, which accommodates a larger filter. In addition, space was provided for two filters: a four-inch MERV 13 and either a one-inch fiberglass pre-filter or specialized post filter (activated charcoal).

The most critical part of the process was to set blower speeds that will achieve optimum performance for heating and cooling, and usually 400 to 500 CFM for the continuous operation. This step required an ECM change-out to replace PSC motors. Some occupants could use the thermostat to control the operation of the blower, and in other cases it was hardwired to run continuously.

This project seeks to educate occupants and install manometers to use pressure drop across the filter to gauge the need for filter replacement.

Results

Currently, 10 systems have been modified. As a result, fine particle levels are significantly lower, the TESP is within the manufacturer's recommendation, and the continuous fan operating cost is under $15/month. Also, the four-inch filters are lasting longer than expected—often up to six months.

Participants have reported fewer respiratory symptoms, quieter HVAC system operation, improved comfort, and lower carbon dioxide levels in bedrooms. The cost of the ECM change-out and return drop modification with a two-part, larger filter rack was $1,000.

Participants reported fewer respiratory symptoms, quieter HVAC system operation, and more.

Industry Implications

When health is a customer's concern, demonstrating a better understanding of home air quality is a good opportunity to stand out from the competition. Adding a better, deeper filter does not achieve this alone.

An oversized central AC system may drive the high TESP, as well as increase the need for a larger motor. Whenever a new AC system is properly sized, a smaller replacement ECM is an option. At the point of HVAC system replacement, the return drop/high MERV filter could be an appropriate addition to provide better energy and filter performance.

Four-inch filters seem to be much less likely to become clogged than one-inch pleated filters. In either case, providing feedback to alert occupants to change the filter could reduce HVAC system problems and improve performance.

There are many opportunities to reduce indoor particle sources. A tighter home, along with similar air handler interventions, can help protect occupants from outdoor particles.

**ROCIS is specific to basement HVAC systems where the system is primarily in conditioned/semi-conditioned spaces, the filter is adjacent to the air handler, forced-air related pressure effects are minimal, and there is little duct leakage to the outside.*

LINDA WIGINGTON is the team leader for the ROCIS initiative. It aims to empower champions in housing, energy efficiency, environmental advocacy, education, sustainability, and health-related sectors. **RHETT MAJOR** has long been helping people in Pennsylvania save energy, provide a healthy living environment, and be more comfortable in their homes and businesses. Major works as a teacher, auditor, mentor, QCI, and training coordinator for Diagnostic Energy Auditors of Western PA. He also maintains a small diagnostic and inspection business.