

Solution for International Residential Code 1503.4: Exhaust Makeup Air in a High-Efficiency Residential Environment

Nathan D. Trant, President and Owner CCB Innovations

Eric W. Trant, BS Chemical Engineering

2012-02-11

SUMMARY

Ventilation efficiency deteriorates rapidly as air is evacuated from an unreplenished and well-sealed ambient source. In a modern, high-efficiency home, air-removal devices such as kitchen hood exhaust, can significantly drop the home's internal pressure. The subsequent drop in pressure results in a rapid deterioration of the exhaust device performance, by as much as 40%.

A Residential Makeup Air System (RMAS) from CCB Innovations (patent pending) can greatly improve such exhaust device performance.

A study performed in a closed environment demonstrated the effectiveness of an RMAS on ventilation performance. **It was shown that without proper makeup air, residential hood exhaust airflow (CFM) can decrease by as much as 40%.** It was then shown that with the proper return air system, such as an RMAS from CCB Innovations, full ventilation efficiency can be maintained.

INDUSTRY REQUIREMENTS

Section M1503.4 of the 2009 International Residential Code (IRC) states: *M1503.4 Makeup air required.* Exhaust hood systems capable of exhausting in excess of **400 cubic feet per minute ($0.19 \text{ m}^3/\text{s}$) shall be provided with makeup air at a rate approximately equal to the exhaust air rate. Such makeup air systems shall be equipped with a means of closure and shall be automatically controlled to start and operate simultaneously with the exhaust system.**

DEMONSTRATION OF VENTILATION EFFICIENCY

Studies in a controlled environment (Fig 1: *Sealed: Well*) demonstrate hood efficiency can be reduced as much as 40%. The corollary here is the modern home, with high-efficiency insulation, windows, and doors, along with a high-performance kitchen hood exhaust system. **This means a kitchen hood specified for an air removal rate of 1,000 CFM (Cubic Feet per Minute), in a high-efficiency home without proper makeup air, could quickly drop in performance to as low as 600 CFM.**

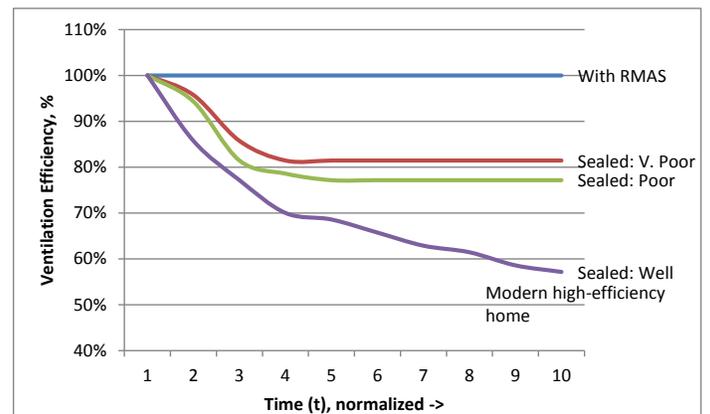


Fig. 1
Controlled Airflow Study
Time (t) is normalized

In poorly-sealed environments (Fig 1: *V. Poor & Poor*), ventilation efficiency is not as strongly impacted, but still shows a significant deterioration in air volume removed from the room. The corollary here would be a less energy-efficient home, with a low-performance ventilation system.

In the same study, using a Residential Makeup Air System from CCB Innovations allowed the exhaust to perform at the vendor-specified CFM rates. With proper makeup return air, ventilation performance

was maintained indefinitely, even in a well-sealed environment. This would compare to a high-efficiency home, with a properly sized RMAS return air system.

DEMONSTRATION OF SOLUTION

According to Section 1503.4 of the 2009 IRC, the solution must meet two requirements:

- 1) Makeup air should be supplied at approximately the same rate as the exhaust ventilation.
- 2) Regulation valves for makeup air should be automated, and synchronized with exhaust.

A system outlined in Appendix I shows the **RMAS from CCB Innovations (patent pending)** meets these requirements. The valve regulating the return makeup air is controlled by the airflow of the exhaust hood. When air flows through the exhaust, a switch is tripped *on*, opening the RMAS makeup air ventilation system. When the exhaust airflow is removed, the RMAS switch moves into the *off* position. This closes the makeup air vent and prevents unwanted air loss from the residence.

Since the control switch lower specification is rated to 200 CFM, it meets the IRC standard that requires makeup air for exhausts greater than 400 CFM.

Since the RMAS system can be scaled to meet any return air situation, including *forced air return*, it meets the IRC regulation that requires a comparable

return air rate as that exhausted. All that is needed is proper scaling and installation of the RMAS control unit.

Furthermore, because the RMAS connections are to the exhaust ventilation, the solution can be applied regardless of hood vendor or exhaust purpose. **The RMAS can interface with any exhaust stream, and is not limited in scope to residential kitchen exhaust hoods, nor to any exhaust vendor.**

CONCLUSIONS

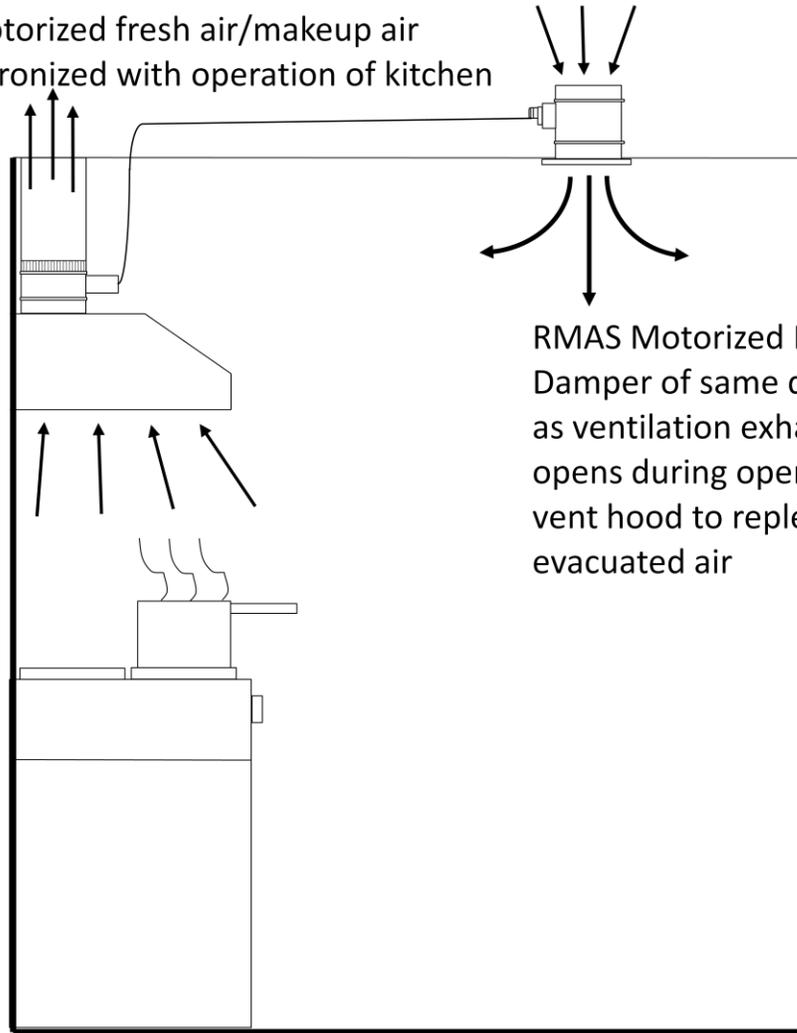
New regulations in the residential exhaust hood building codes require an effective solution that can be quickly brought to market. The solution must be effective, versatile, affordable, and reliable, and it must meet the 2009 IRC specifications.

A study in a controlled environment demonstrated a solid case for implementing makeup air in a residential setting. The study showed up to a 40% loss in exhaust performance, if no makeup air system is implemented.

The same study demonstrated the Residential Makeup Air System (RMAS) from CCB Innovations meets the IRC standards, and provides a reasonable and realistic solution for the building market.

Operation of motorized fresh air/makeup air damper is synchronized with operation of kitchen exhaust system

RMAS Switch Assembly (Patent Pending) mounted above kitchen exhaust hood



RMAS Motorized Fresh Air Damper of same diameter as ventilation exhaust duct opens during operation of vent hood to replenish evacuated air