CITY OF NAPERVILLE
MEMORANDUM

DATE: September 27, 2012

TO: Doug Krieger, City Manager

FROM: John Rutkowski, Development Services Team Leader – T.E.D.

SUBJECT: October 2, 2012 City Council Agenda Item J1 - 2012 International Building Code Update

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PURPOSE:

The purpose of this memorandum is to provide the City Council with additional information related to domestic kitchen exhaust make-up air requirements.

BACKGROUND/DISCUSSION:

The following documents are included with this memorandum:

- Attachment 1 is an article from a home energy magazine (1999) providing an overview of the topic;
- Attachment 2 summarizes the benefits of providing make-up air; and,
- Attachment 3 is a document from Broan, North America's largest producer of residential ventilation products such as range hoods, ventilation fans and indoor air quality products, depicting the make-up air system they currently sell in the marketplace.

RECOMMENDATION:

It is recommended that this information be sent to the City Council for their review and consideration.

Attachment 1

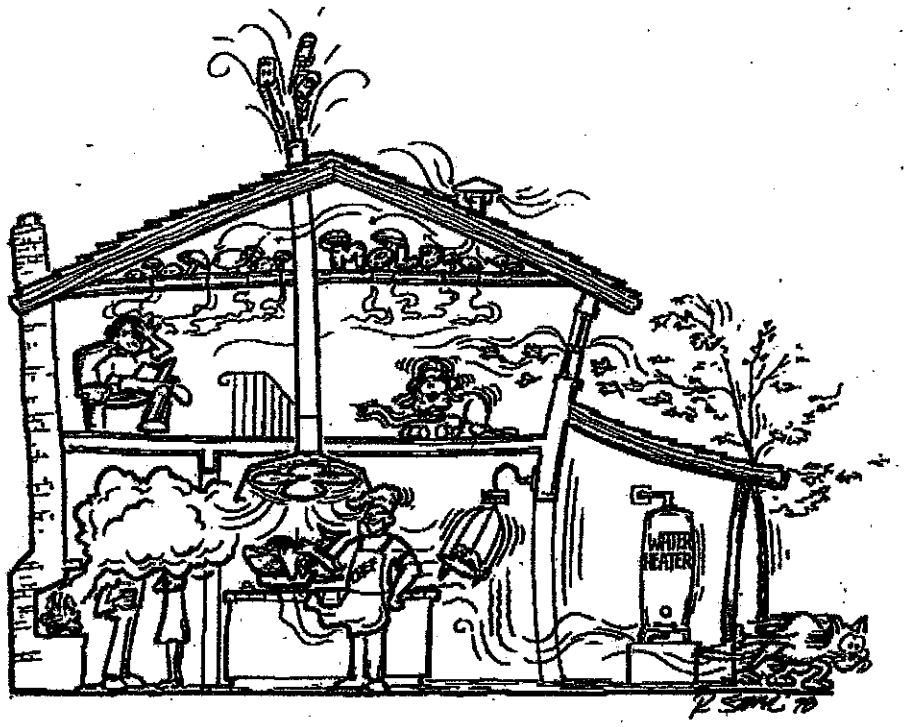
Home Energy Magazine Online January/February 1999

Oversized Kitchen Fans-- An Exhausting Problem

by Bruce Manclark

Bruce Manclark is co-owner of Delta-T, an energy services company in Eugene, Oregon. He has spent 20 years in energy conservation.

No longer relegated to the garage or the workshop, the search for more power is taking over the kitchen, as commercial-sized kitchen fans invade the home. The problem is, residential kitchens aren't regulated the way commercial kitchens are. This causes potential hazards when these huge fans are turned on.



More Power! The Bigger is Better mentality strikes deep into the heart of the American home. Sure, American consumers will live with low flush toilets; they'll put up with low-wattage lights; but when it comes to the kitchen, they want the culinary equivalent of the sports utility vehicle. They are going for commercial quality and commercial-sized equipment in a big way. This means bigger refrigerators, larger stoves, and especially, bigger kitchen fans.

Since *Home Energy* last reported on the issue of kitchen fans (see

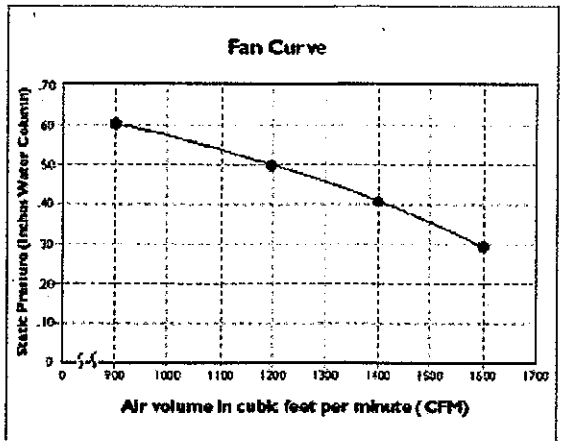


Figure 1. A fan curve illustrates the effect of static pressure on the performance of the fan. As the pressure (imposed by the resistance of the hood, exhaust duct, and tightness of the house) increases, the flow decreases.

This Thermador Professional Series 36 gas cooktop with hood can hold a fan as large as 1,400 CFM.

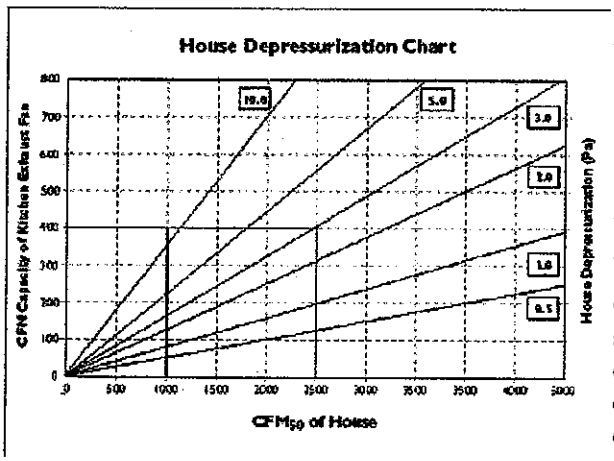


Figure 2. A house will become more depressurized as its tightness increases or as the size of the kitchen fan is increased.

Home, Home on the Range Hood, *HE* Nov/Dec '97, p. 9), sales of high-end residential equipment have only increased. The range hood and exhaust fan are no longer hidden behind cabinets--now they are the focal point of the kitchen. They are architecturally designed and have hand-finished surfaces; and they are powerful--often with more capacity than an HVAC fan.

Power to the People! In the past, most of the residential kitchen fans we tested at our company exhausted around 100 CFM. This isn't much, but 100 CFM is the minimum required by ASHRAE Standard 62, and it is generally adequate to remove excess moisture and cooking odors, depending on what's cooking and how well the hood captures the fumes. In any case, it is a big improvement over no kitchen fan or the faux fans that I see in roughly 20% of my clients' homes, which send the exhaust through an inadequate filter and recirculate it back into the house. Until recently, the biggest kitchen range fans we saw were around 350 CFM, and downdraft stove units (built into the stove) were up around 600 CFM. The newer fans we encounter now range from 600 to 1,500 CFM, and one manufacturer boasts a rating of 2,400 CFM. A 2,400 CFM residential kitchen fan is enormous! By way of comparison, a Minneapolis Blower Door can exhaust 6,000 CFM.

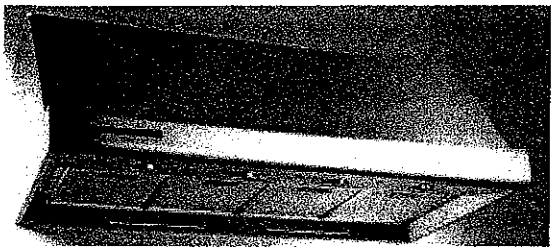
Another indication of the growing size of kitchen fans can be found in the *Certified Products Directory* of the Home Ventilating Insitute (HVI). The 1990 directory listed 33 range hood fans over 250 CFM, with the largest rated at 1,170 CFM. By 1995, this had increased to 39 fans. By 1998, it listed 52 range hoods rated at 250 CFM or more, with the largest rated at 1,200 CFM.

To picture the effect of such a large fan on a home, imagine that the range hood is attached to a giant vacuum cleaner on the outside of the house. The vacuum draws air out of the house, which depressurizes it. As the level of depressurization increases, other appliances that typically exhaust air begin to backdraft, pulling fumes back into the house. For example, smoke in a backdrafting chimney is pulled by depressurization back *down* the chimney. The fumes in a backdrafting water heater are sucked back *down* the exhaust flue and into the house. Finally, backdrafting is extremely dangerous. According to the Consumer Products Safety Commission (CPSC), 214 people died in US homes from CO poisoning in 1993 alone.

Ventilation Versus Evacuation Vented kitchen fans help to maintain good indoor air quality. They remove combustion pollutants, moisture, cooking odors, and grease from the house. Commercial kitchen range hoods must deal effectively with grease, in particular. One reason that commercial fans are so powerful is that they must maintain a high enough velocity to draw all contaminants into the hood. If this is not accomplished, grease gets deposited throughout the kitchen, creating a risk of fire.

Cooktops with eight burners plus a grille are showing up in residential settings. There are various rules of thumb for matching the size of the cooktop to the size of the fan. A common one is 300 CFM per linear ft of cooktop. Thus a 48-inch cooktop needs a 1,200 CFM fan. These rules of thumb come from the commercial sector where codes are very specific about the installation of kitchen fans.

This is in sharp contrast to how kitchen fans are installed in a residence. There is no language in the residential codes that ensure the safe installation of large commercial fans. The residential kitchen ventilation requirement in all three Model Codes and ASHRAE Standard 62 is for a



A Thermador 49 Professional Series Wall Hood in stainless steel has the look and feel of a commercial fan, but it isn't subject to the same regulations.

100 CFM fan or range hood. The industry recommendation from the HVI is for a minimum of 40 CFM per linear ft of cooktop. According to this rule, a 48-inch cooktop needs only a 160 CFM fan.

Makeup Air To operate any fan safely, the air that is exhausted from the inside to the outside must be replaced. This is why the Uniform Mechanical Code (UMC) requires makeup air for commerical kitchens. Makeup air is air that is intentionally pushed or pulled into the building in an amount more or less equal to the amount of air that is exhausted by the kitchen fan. Makeup air prevents fuel spillage and backdrafting from vented combustion appliances, such as gas water heaters or fireplaces, within the restaurant. Another purpose of requiring makeup air is to ensure that the fan can actually exhaust at its rated capacity. If the fan isn't running at its rated capacity, it does not maintain sufficient air velocity to trap the various emissions from the cooking surface. A building's tightness and exhaust duct configuration will affect the amount of air that fans inside it can exhaust. The tighter the building, the greater the pressure the fan has to operate against and the less air the fan can move. The amount of air that a fan can move against any given pressure is called its fan curve (see Figure 1). Get too low on this fan curve, and a 1,200 CFM fan might exhaust only 1,000 CFM.

Makeup air is usually tempered (heated or cooled to offset the outside temperature) to ensure the comfort of kitchen staff. Installing makeup air devices also ensures that large amounts of air from the eating area of the restaurant are not drawn into the kitchen. This can create drafts that affect the comfort of the diners.

In many jurisdictions, the owner of a commercial building must pass a performance-based test that certifies that the makeup air is sufficient for the fan and grease filter to work safely. Testing and balancing companies typically administer these tests. They measure the flow of both the exhaust and supply fans and check to make sure the restaurant is not depressurized.

Residential No-Codes With few exceptions, residential codes are silent on the question of providing makeup air. The Uniform Mechanical Code (section 706, 1994 edition) states vaguely that operation of exhaust fans, kitchen ventilation systems, clothes dryers, or fireplaces shall be considered in determining combustion air requirements to avoid unsatisfactory operation of installed gas appliances.

While deconstructing this passage might prove humorous, what it actually means is a moot point, because the only way to ensure that unsatisfactory operation of installed gas appliances does not occur is to *test* for it. The *goal* is to design buildings and systems that work properly in the first place and do not require significant modification. It is important to remember that combustion air is not the same thing as makeup air. Combustion air is the air used by appliances such as gas water heaters and furnaces, and is related to the Btu of the device--the more Btu's are generated, the more air is needed and the larger the vent needs to be. Although combustion air inlets may in some cases help lessen depressurization, it is not what they were designed to do.

Generally speaking, the tighter the house the more likely it is that depressurization will be a problem (see Figure 2). As an example, a kitchen fan drawing 800 CFM in a house with a blower door reading of 2,000 CFM at 50 Pascals (Pa) would cause the house to become depressurized to about 10 Pa. This is enough to backdraft fireplaces and gas water heaters.

As Figure 2 indicates, even a standard kitchen fan of 400 CFM may be sufficient to cause backdrafting in any home tighter than about 1,000 CFM at 50 Pa. But imagine what happens when the fan is designed to exhaust 2,000 CFM. Unless the house has screen doors for exterior walls, the fireplace will backdraft. According to a study done by the federal Bonneville Power Administration, a fireplace with glass doors or an airtight wood stove will backdraft at less than 5 Pa. Some fireplaces with glass doors backdraft at 8 Pa of stack-induced pressure.

Homeowner comfort is another important issue. Imagine a winter holiday party. All the friends and family are milling around. Outside it is cold and snowy; inside there is a roaring fire in the fireplace. The host fires up the range to prepare some hors d'oeuvres, turns on the kitchen fan, and suddenly the house is full of smoke and cold air. Another family Kodak moment is made.

What to Do? People who are familiar with home diagnostics recognize the benefits of worst-case depressurization testing. This is a test to make sure that when the various mechanical systems in the house are operating, all vented combustion equipment can vent properly. Unfortunately, it is unlikely that this test will be written into code language any time soon, with a few notable exceptions. The Canadian National Building Code, as well as the energy codes in Minnesota and Wisconsin, require that the homes are performance tested. Minnesota requires the test to show compliance under the performance path.

As a mechanical contractor, I have no control over the tightness of a house where I am asked to install a kitchen fan. I cannot rely on the house being built poorly enough to rescue me from any potential problems. I must design a safe system, which is a system that supplies makeup air. The goal is simple: to supply an amount of makeup air equal to the amount of air that is exhausted by the fan.

The goal may be simple, but the actual design and installation may not be so easy. Supplying large amounts of air to a house as inconspicuously as possible is the key to homeowner approval. Opening a big window would probably do the job and is certainly the low-cost approach. However, 2,000 CFM pouring through an open window when it's 30° outside is not a good option for most consumers. There are more practical steps to take in the design of a residential air makeup system (see Designing a Makeup Air System).

The Exceptions In recent years, there has been some movement to set guidelines for the use of exhaust fans in residential kitchens. Recent changes in some building codes reflect the potential hazards of backdrafting caused by exhaust fans. Unfortunately, while some first steps are being taken on the right path, others are simply continuing down the wrong path at a faster pace.

Prescriptive

The wrong path is prescriptive. Prescriptive coding works well for such things as determining the minimum size for a floor joist on 16-inch centers for a 16-ft span. The user looks at a table and has an answer. Because we have enough engineering data about the wood we are using, this approach works for such applications. However, it does not work well for kitchen fans.

Among those on the wrong path is the State of Oregon, which has amended the UMC to require that when a fan with a rating of greater than 350 CFM is installed, there must be a 6-inch duct that allows outside air into the zone. This approach gives a prescriptive answer to a problem created by a prescriptive code. This says that it doesn't matter how leaky the house is, that it doesn't matter how much larger the fan is than 350 cfm, and that simply putting a hole in the house will solve the problem. It also ignores the fact that, depending upon where it is, the hole itself may actually depressurize the building! Assuming that the 6-inch hole works as a pressure relief valve, it will allow only about 50 CFM through when the house is depressurized by a 350 CFM fan (assuming average tightness).

Performance

The right path is performance. This means that a test is used to determine whether a given installed system works as specified. Plumbers must pressurize the plumbing system, and it must hold that pressure for a given amount of time before an inspector signs off on it. Determining the leakiness of a plumbing system using a prescriptive approach would result in leaky piping and high utility bills.

An example of a code that is taking the path of performance is the Canadian General Standards Board 51.71-95. This code sets limits for depressurization caused by any source for a variety of combustion appliances. The limits are 5-20 Pa for various types of combustion appliance, such as fireplaces and condensing furnaces. This code requires testing. Nothing is assumed about the leakiness of the house; nothing is assumed about how much air a fan is exhausting. The worst-case depressurization test tells the inspector whether the system passes or fails. The 1999 Minnesota Energy Code uses a similar performance table with limits of 2-25 Pa for different appliances. It also allows the use of a prescriptive table or performance testing. The code requires a supply fan for kitchen exhaust flows over 250 CFM if direct vent appliances are used, and a supply fan for all kitchen exhaust for other appliances. Flows must be matched within 10%.

Do It Right Kitchen fans are important to maintaining good indoor air quality. At least one manufacturer says that its larger fan promotes a healthy house by helping the house breathe. Unfortunately, if what the residents are breathing is combustion by-products drawn into the house by a kitchen fan, then these powerful fans only serve to degrade the indoor environment and endanger their health.

If large kitchen fans are installed at all, they must be installed as a part of a kitchen ventilation system that includes makeup air, and these systems must be performance-tested in the field.

Designing a Makeup Air System

Step 1: Persuade the homeowner to limit the size of the fan. Unless the homeowners are cooking for the entire neighborhood, they don't need a huge kitchen fan. Many companies install multiple fans and multispeed fans in the same hood so that they can be switched on incrementally. Remember that the homeowner mostly wants to make sure that the hood removes cooking odors from the house, and that the hood design is very important in trapping various pollutants. Experts agree that the range hood should overlap the cooktop by a few inches on all sides, and that it should be between 2 ft 8 inches and 3 ft from the cooking surface. It is also unlikely that all the burners will be on at the same time, so limiting the fan to less than 600 CFM even in homes with big cooktops will make it easier to provide makeup air. If the homeowner for some reason thinks the fan is too small, additional fans may be installed.

While more power is important to some people's psyche, what is probably driving the market is the aesthetic appeal of architecturally designed range hoods. Hoods are often the focal point of the modern open kitchen. According to Seattle architect Mark Frankel of Ecotope, what the average buyer of these hoods wants is the look and style. What the manufacturers need to do is keep the look and drop the fan size to more appropriate levels.

Step 2: Decide where to introduce the makeup air. The logical choice is to bring air into the kitchen somewhere. Supplying it

through soffits or under toe kicks beneath the cabinetry is our first choice. But there are a lot of other places to introduce the air, depending on the type of house and the owner's preferences. One option is to use an inline fan and force the air into the return air plenum of the furnace, so there is some potential for tempering and filtration (this would work well with small kitchen fans, but not with large ones).

Step 3: Determine how much makeup air is needed. If sufficient makeup air is provided, no depressurization will occur. Obviously, some makeup air will be provided through leakage. However, it is best not to count on that. Size the makeup air to match the fan.

Step 4: Decide whether or not to temper. Except in very mild climates, it will probably be necessary to temper the incoming air during cold weather. This is most easily done by using inline duct heaters--also known as resistance heat--that kick in when the incoming air is below a set temperature. We set ours at 50° F.

Step 5: Develop a control strategy. The makeup air system must work whenever the kitchen exhaust is running. When the fan is turned on, a motorized damper opens and the supply fan turns on. If the kitchen fan has multiple settings, the makeup air system may also need multiple adjustments. A 300 CFM kitchen fan does not need 900 CFM of intake air.

The supply fan moves more air when the kitchen fan is turned to a higher setting. If the temperature of the air is below preset limits (50° of supply air), the inline heater comes on.

Step 6: Test the system. Worst-case depressurization testing is critical. It is impossible to know the tightness of the house, and the interactions between teh makeup air system and other mechanical systems, without testing. The worst case depressurization test tells you if the makeup air matches the exhaust air, and if other combustion appliances will backdraft.

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ABOUT MAKE-UP AIR :NEGATIVE AIR PRESSURE AND FRESH AIR INFILTRATION

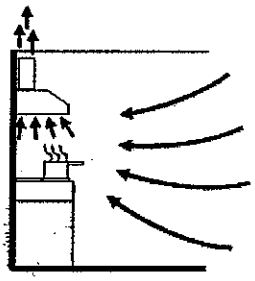
What is Negative Air Pressure?

In recent years, residential homebuilders have greatly increased the energy efficiency of the houses being built by better sealing and insulating them from outside air. By encapsulating the home from leaking air in or out, the builders are met with a whole new set of challenges, one of which is negative air pressure created by high CFM (cubic feet per minute) kitchen exhaust hoods.

Negative air pressure is essentially your home creating a low level vacuum inside itself to try and draw replenishment air from any opening it can find to the outside. Older, less efficient homes could balance the internal air pressure by air "infiltration" or "exfiltration". Infiltration meaning external air from the outside entering the home, and exfiltration meaning internal air escaping to the outside. This type of air exchange or "leakage" in residential homes was mostly due to exterior walls, attics, doors, and windows not being sealed as tightly as they are today.

To maintain higher levels of efficiency while heating and cooling, the air leakage needs to be reduced or eliminated. And by reducing air from entering and exiting your home , the internal pressure can become compromised if the air is not properly exchanged.

How is Negative Air Pressure Created by the Kitchen Exhaust System?

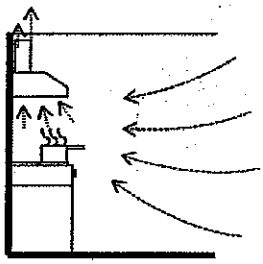


(fig.1)

A high CFM kitchen ventilation system can deplete the air supply inside your home rapidly (fig.1) while exhausting your cooking surface. For example, a 600 CFM (cubic feet per minute) vent hood can deplete the air in a kitchen with a 10ft ceiling that is 10ft wide and 10ft deep (length x width x depth = cubic feet) in less than 2 minutes.

A residential single-family home ranging in size from 2,500 to 3,500 square feet can contain approximately 25,000-35,000 cubic feet of air inside it. If a kitchen vent hood is exhausting 600 CFM (cubic feet per minute) then it would take less than 1 hour to exhaust the cubic foot air equivalency of your entire home to the outside. A properly installed HVAC system's air exchange rate will be able to maintain a relatively stable air pressure balance in your home, but is not designed or calibrated to compensate for the air lost during the intermittent use of a high CFM kitchen exhaust hood. This could lead to negative air pressure in your home.

How Does Negative Air Pressure Affect Your Home?

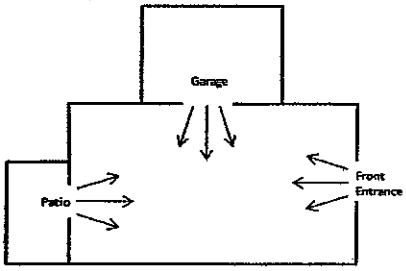


(fig.2)

Exhausting the cooking surface properly is necessary to maintain a healthy environment inside your home. The primary function of a kitchen range hood is to capture, contain, and exhaust smoke, grease, heat and odors to the outside of your house. This reduces the amount of unhealthy air and toxins that are being released into your internal air supply while cooking food. But without providing replenishment air or "makeup air" from outside your home, the kitchen exhaust system will begin to create a level of negative air pressure. Without a way to replenish the exhausted air, over time your kitchen ventilation system will begin to lose efficiency (fig.2).

And with less air in your home to exhaust, your vent hood cannot maintain the manufacturer's CFM rating. This will result in a failure to capture and evacuate potentially hazardous and unhealthy air.

There are many ways for outside air to enter your home, even if it is built to the highest efficiency standards. A tightly sealed home will try and balance the negative air pressure created by a high CFM kitchen exhaust hood by pulling from the largest and most convenient openings to the outside.



One of the most common ways is through entry doors. And in some cases, negative air pressure could even stall or reverse the airflow in combustion vents (combustion vents meaning passive exhausts that rely on the buoyancy of hot air to lift and exhaust) like chimneys and furnace exhausts.

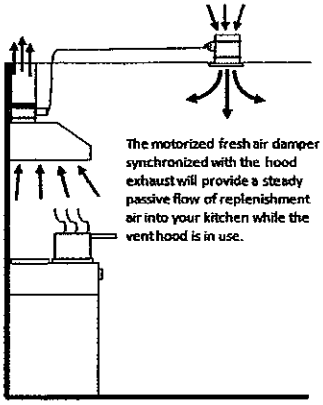
This could result in large amounts of outside air containing dust, toxins, and allergens rapidly entering your living space. Ground level toxins drawn in from front and patio entrances could include dust, pollen, spores, or herbicides. And the garage entrance could potentially draw in carbon monoxide from car exhaust as well as paint, fuel, and chemical

FIND OUT MORE...

Attachment 2 cont.

vapors from stored items. None of these are ideal sources of air replenishment for a home.

What is the Solution?



By creating a makeup air infiltration point localized to your kitchen ventilation system, the air is replenished at a slower and more controlled rate during the operation of the kitchen vent hood. To do this effectively, the operation of the kitchen ventilation system needs to synchronize with the operation of the motorized fresh air damper. The damper needs to open only while air is being exhausted from your kitchen and remained tightly closed when not in use.

Synchronization of the fresh air damper with the kitchen vent hood can be achieved using the Residential Makeup Air System (RMAS) from CCB Innovations (patent pending). This allows the operation of any kitchen exhaust system to connect to a fresh air damper 3-5ft away from the exhaust hood to bring in fresh, clean, healthy air to balance the pressure change in your home.

By maintaining an equivalent air exchange rate, the potential for negative air pressure during operation of your kitchen vent hood is significatly reduced. This will provide a healthier and cleaner air supply inside your home.

Even if not required in your area for residential homes, installing a fresh air intake with a high CFM kitchen ventilation system is always a good idea. And because the Residential Makeup Air System (RMAS) by CCB Innovations is universal to high CFM vent hoods, it can be installed in any new home, or even retro-installed, in an existing home to provide a cleaner and more balanced air supply for you and your family.

FREQUENTLY ASKED QUESTIONS (FAQS)

1. What does the Broan Automatic Make-Up Air Damper do?

The Broan Automatic Make-Up Air Damper (the "Damper") provides a pathway for fresh air to enter a home from outdoors when a compatible exhaust device is operating. The Damper opens when a compatible BEST or Broan range hood is operating, thereby creating a known, controlled point for fresh air to enter the home while air is being exhausted from the building by the range hood.

By operating in this manner, the Damper provides two key benefits for the home:

- It facilitates air exchange between indoors and outdoors, by helping to allow fresh air into the home to replace air which is exhausted out of the home.
- By allowing fresh air into the building when a compatible exhaust device is on, the Damper helps to avoid negative pressure conditions within the home which may interfere with the proper operation of combustion equipment within the home.

Overall, the Damper let's your Broan or BEST exhaust devices do their job more effectively and without interfering with the proper operation of other home systems.

2. Does the "Damper" provide combustion air for combustion appliances like a water heater or a furnace?

No. The Damper helps to replace air which is exhausted by a compatible range hood. But it does NOT help to replace air which is drawn from the indoors by a combustion appliance like a natural gas water heater, and it should not be relied upon to perform this function. One main reason for this restriction is that the Damper is only open when the range hood that it's connected to is operating. So there is no assurance that the Damper would be open when other appliances, like a water heater, are operating. Other means must be provided to ensure adequate combustion air for these appliances.

3. How do I know if I need make-up air for my range hood?

In some cases the local building code may tell you that make-up air is necessary. For example, some codes specify that range hoods with exhaust flows of 300 cubic feet per minute (CFM) or higher need a mechanical system to introduce make-up air.

In other cases, make-up air for a range hood is desirable regardless of whether code requires it. This is especially true for:

- larger range hoods (those over 300 cfm)
- homes which are well air-sealed - so outside air may not be able to easily find its way into the home through cracks, to replace air which is exhausted out
- homes with atmospherically vented combustion appliances (i.e. a water heater or natural draft fireplace), which are more susceptible to improper venting if depressurization occurs in the home.

In homes with any one of these factors make-up air is advised. And in homes with more than one of these conditions make-up air for the range hood is strongly advised.

4. What are the benefits of providing make-up air to replace air which is exhausted out of the home by a range hood?

Range hoods are designed to pull out pollutants like cooking odors or moisture at the source, so they don't linger in the home. Because these fans pull air out of the house, this air needs to be replaced with "new" air from outdoors. Normally this make-up air enters the home through cracks and holes in the "shell" of the building. But modern homes are air-sealed much more thoroughly so there are not as many cracks and openings. Plus some exhaust fans like range hoods exhaust a lot more air than can be replaced through normal cracks in the building shell.

By providing an intentionally designed opening for fresh air to replace air which is exhausted out by the range hood, several important benefits result:

- The make-up air entering the home comes in at a known point, where it is also filtered
- Negative pressure conditions, which could arise if air is exhausted from a home without being replaced by new fresh air, are prevented
- Pollutants are more effectively exhausted from the home while fresh replacement air is drawn into the home, improving ventilation

5. Does ASHRAE 62.2-2007 – "Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings" – require the use of a make-up air damper?

ASHRAE 62.2-2007 does not specifically require make-up air dampers. In a few limited circumstances, this standard does require that net exhaust flows from a house be limited. For example, Section 6.4 of the standard limits the net exhaust flow from a home's two largest exhaust appliances if the home has atmospherically vented or solid-fuel burning appliances located within the pressure boundary of the house. This standard is available at www.ashrae.org.

6. Can I use the Broan Automatic Make-Up Air Damper with other equipment in my home?

No. The Broan Automatic Make-Up Air Damper may only be used with compatible BEST or Broan range hoods. More information on exact models of the Damper and compatible exhaust devices can be found in the Broan Automatic Make-Up Air Damper Application Guide.

7. What are the different ways that the Damper can be installed in my home?

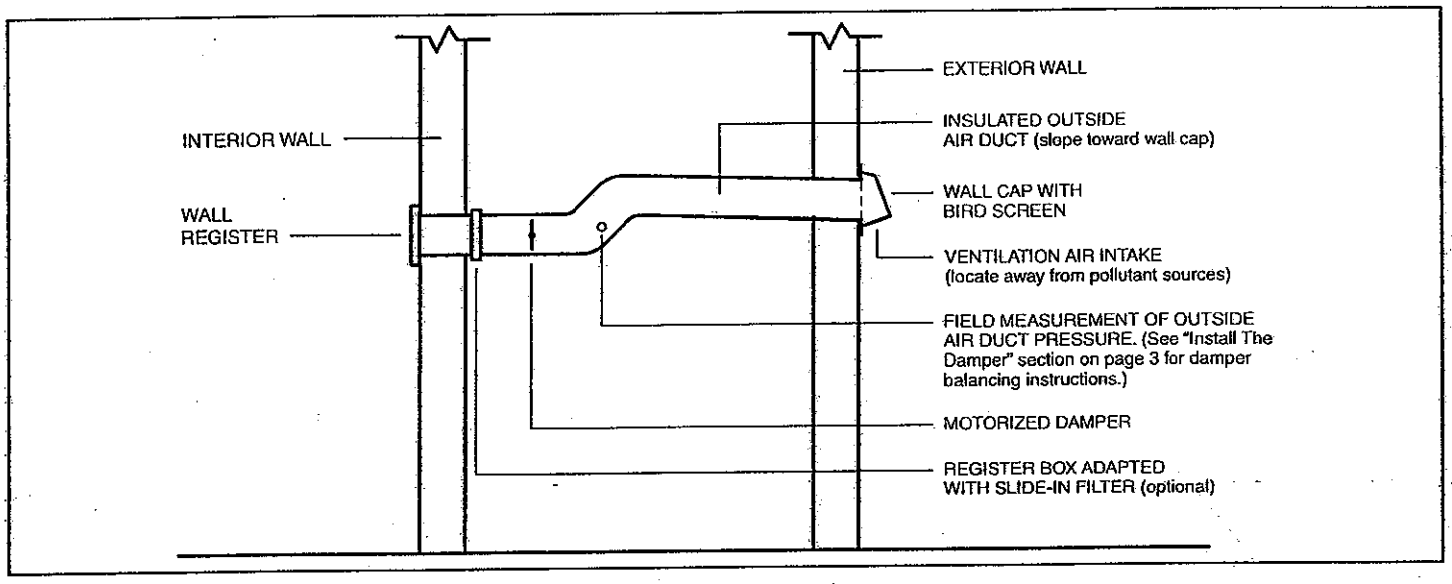
The most common way to install the Damper is to connect it to a home's central duct system. In this application, outside fresh air enters the home through the Damper and is then routed and distributed through the home's ducts. More information on this installation approach can be found in the Broan Automatic Make-Up Air Damper Application Guide on our web site: www.broan.com.

8. What if my home doesn't have ducts?

Homes without ducts can still utilize the Damper to help replace air which is exhausted from the home by the range hood. An installation illustration for this situation is included in the Broan Automatic Make-Up Air Damper Application Guide on our web site: www.broan.com.

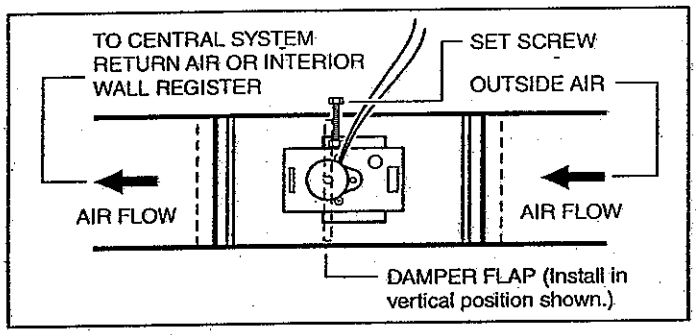
9. What happens after a power outage?

The Damper system and the associated exhaust devices will not lose their settings following a power outage. So the system will resume its normal operation following a power outage, based on the settings it used prior to the outage.



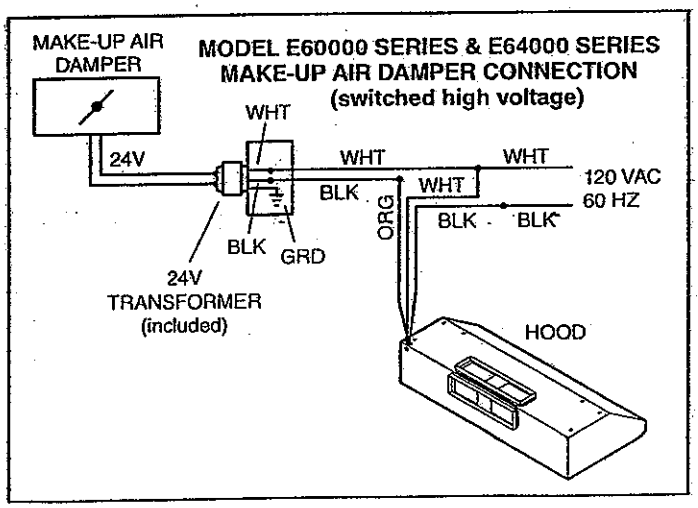
Damper and outside air duct connected directly to a ceiling, floor, or wall register.

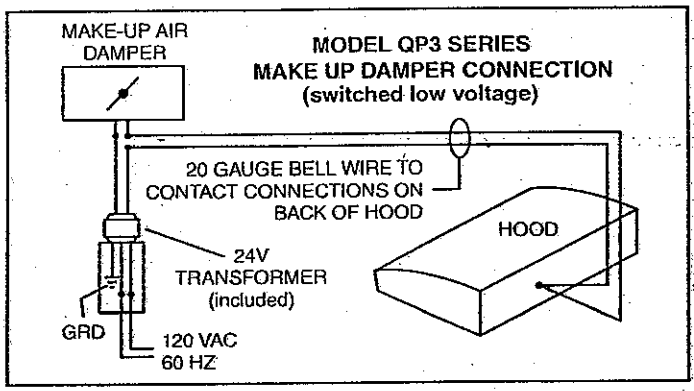
INSTALL THE DAMPER



Install the damper as shown. Make sure damper flap is in a vertical position when closed and power is off. The set screw can be used to adjust the damper opening - thereby balancing the inside and outside air pressure when the range hood exhausts at high speed.

Wire the system as shown.





SYSTEM OPERATION

Once the Damper and the associated Broan or BEST exhaust devices are installed, the installer should confirm that the Damper opens and closes in conjunction with signals from the exhaust devices(s) as intended.

A qualified HVAC contractor should also ensure the proper operation and venting of all combustion equipment in the home.

MAINTENANCE

Regular maintenance is necessary to ensure the proper operation of the Damper system. Failure to conduct such routine maintenance can jeopardize the ability of the Damper to introduce fresh air into the home. Regular maintenance should include the following activities:

- Clean the outside bird screen to ensure it is free from debris and open to allow fresh air to enter.
- Clean or replace the interior filter(s) which serve to filter fresh air before it enters the home.
- Maintain a clear opening at the outdoor end cap, which means preventing the buildup of snow, leaves, or vegetation at the end cap.
- During regular HVAC maintenance, have the mechanical contractor inspect the Damper system for proper operation.