The Voice of GFEN

Understanding Today's Kitchen Ventilation Designs

and some simple solutions for "sick hood syndrome!"

Tom Stroozas - CFE, RCGC, CFSP
Stroozas & Associates
GFEN Consulting Editor

Ventilation is the single most important factor in the design, construction and efficient operation of today's commercial kitchens. Not only is good ventilation important for the comfort of occupants in any enclosed space, but also national, regional and local codes are becoming increasingly strict. Environmental standards are being tightened to require even cleaner exhaust.

In a foodservice environment with its array of cooking equipment, a properly performing exhaust system is essential to deal with the effects of heat, cooking effluent (grease and smoke), odors, moisture, pollutants and other airborne contaminants. Without a constant suply of fresh, clean air, cooking in confined spaces would be nearly impossible and dining would be uncomfortable.

The amount of ventilation required in a particular restaurant depends on various factors such as the type of products being cooked, the type of equipment used, the structure which houses the cooking area, and local code regulations. In addition, depending on where you are located, the building heat source may also play a factor.

The Cooking Equipment Factor

The type of cooking that a restaurant does and the equipment used has a direct influence on the design and "horsepower" of the ventilation system. Some kitchens will use more ventilation energy than others. For example, kitchens where fryers, charbroilers and griddles are in use generate more heat and effluent than those specializing in the preparation of lighter meals such as salads, sandwiches and soups.

Fryers, charbroilers and griddles release high amounts of pollutants. Ovens used for cooking pizzas and other baked foodstuffs release intense heat when the doors are opened. And, with today's popular steamers and combination oven technologies, super-heated steam, poses added challenges for ventilation systems.

A Look at Hoods

Without an effective and efficient hood, the extraction of cooking effluents could not be accomplished, and the kitchen would be a most unpleasant place to work. Over the years, terminology has developed in regard to hood types, design and performance. A few of these common terms include: backshelf, canopy (island or wall), and recirculating (self-contained ductless for electric equipment only) hoods; SP (supply plenum), CFM (cubic feet per minute) and MUA (make-up air).

Hood size is determined by the size and capacity of the cooking equipment. The capacity of the hood itself, is expressed in CFMs, and is determined by three primary factors:

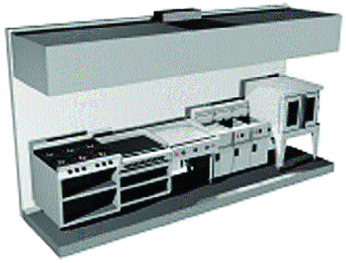
1. The type of cooking equipment used such as fryers, ovens, charbroilers, etc. mentioned earlier;

2. Air flow restrictions – walls, fabricated enclosures, etc.

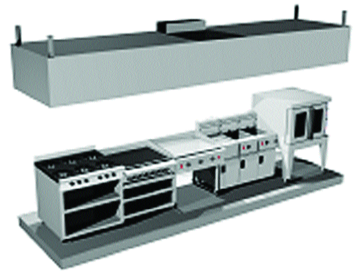
3. UL710 code and more importantly, local code.

These factors define the velocity and rate of expansion of the air in the generated updraft. Appliances with large, heat-radiating surfaces like charbroilers and grills, produce a stronger updraft than say, an oven, which is designed to contain the heat it produces more within a confined space, at least until the door is opened.

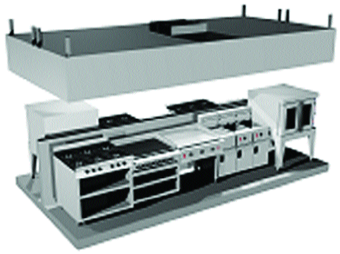
The kitchen walls, fabricated enclosures and the



Wall Mounted Canopy



Single Island Canopy



Double Island Canopy

Back Shelf

type of hood system used determines how much exhaust air is needed. The more enclosed the cooking equipment, the less exhaust is needed for proper ventilation. An appliance that is open on all sides, requires more exhaust volume than when only one side is open.

Backshelf or Canopy?

There are a number of variations on both backshelf and canopy hoods. Your menu and equipment will dictate which system design is right for you.

Backshelf hoods are best suited for low cooking surface appliances: griddles, grills, fryers, etc. Placing a backshself hood in close proximity to the cooking surface requires less exhaust than a canopy hood used in the same application. This is why the backshelf hood is widely used in today's quick-serve and short-order foodservice establishments that typically use fryers and griddles as their primary cooking equipment.

The backshelf hood is not suitable for tall appliances such as steamers and ovens, or for facilities that produce large volumes of effluent or steam. For such applications a canopy hood is the better choice.

Canopy hoods require larger volumes of exhaust air than the backshelf design. They are suitable for ventilating any type of cooking operation and are more flexible as to where they are placed; i.e. next to a wall, or placed in the center of the kitchen with a 360° "island style" cooking radius. For that reason, canopy hoods are the predominant system used in today's full-service facilities.

Canopy Hood Sizing

There are four important issues to be mindful of when determining hood size:

1. Cooking equipment layout:

Most applications require a minimum 6 inch overhang on each side of the cooking equipment surface, except for charbroilers, which require a minimum 12 inch overhang. The more overhang, the better. And, for island canopy configurations, the increased hood overhang has proven to be one of the most effective performance enhancements.

2. Wall locations:

Determine the wall locations around the hood perimeter. If the cooking equipment is against a back wall and in the corner, the hood would require a minimum 6 inch overhang on the front of the equipment and a minimum 6 inch overhang on one end only. If the hood is to be open on both ends, then a 6 inch overhang must be allowed for each end if the hood is within 18 inches of non-combustible construction.

3. Height limitations:

The ceiling will determine the height of the hood. The front lip is placed 78 inches above the floor as required by the mechanical code.

4. Island Canopy Hood Differences:

Many larger restaurants with display cooking configurations and institutional establishments will incorporate the island canopy configuration as a means to maximize production space and logistics. Recent tests conducted by the Food Service Technology Center (ASHRAE Research Project 1480) confirmed that single-island canopy hoods require much higher exhaust rates than their wall-mounted counterparts to effectively ventilate cooking equipment. For example, while an exhaust rate of 300 to 400 CFM per linear foot can be adequate for capture and containment with a wall-mounted canopy hood over a heavy-duty cooking line, a single-island canopy hood may require an exhaust rate in excess of 500 CFM per linear foot in many situations (measured along one side of the canopy hood). In fact, there were several test scenarios for single-island hoods where an exhaust rate in excess of 700 CFM was required to achieve proper capture and containment.

Air Flow & Make-Up Air

The ventilation system must exhaust the heat produced and remove the moisture and cooking effluents. When a ventilation system breaks down, the cooking environment can soon become a very unfriendly place to work. Thus, a constant supply of fresh and clean air is essential!

Every commercial kitchen requires make-up air to compensate for the air exhausted from the cooking environment to remove heat, moisture and cooking effluents. It is also essential to maintain a comfortable working environment. This make-up air may be extracted from the building HVAC system, which is frequently done. It may even be extracted from the HVAC system in the kitchen area; or it may be integrated into the hood itself, which is commonly known as a "short circuit" system.

There is a common misconception that taking air from a conditioned space within the kitchen area is inferior to incorporating a short circuit type system integrated into the hood. This assumption is false. Given the fact that a hood that incorporates its own make-up air system can cost up to twice as much as a capture only hood, we have seen a significant decline in the sale of this once popular integrated design.

Smoke tests have proven the effectiveness of capture only systems that pull make- up air from the room where it is employed. Remember the objective here is to provide a clean and comfortable cooking environment and a less expensive, capture only hood with make-up air from the kitchen area, can prove to be the preferred way to clear the air and reduce hood expense by design.

During tests with a double island canopy configuration, when local make-up air was introduced aggressively through 4-way ceiling diffusers, perforated ceiling diffusers, or a high-flow perforated perimeter supply system, hood performance was drastically reduced. For this type of configuration, when the perforated perimeter supply system was operated at a low-flow, low velocity condition, it was the best of the local make-up air configurations tested. Higher replacement air temperatures from ceiling diffusers also degraded the performance of island hoods. And, unbalanced replacement air distribution was extremely detrimental to the performance of the double-island hoods, so symmetry of diffusers is indeed important.

For areas with colder climates, many manufacturers offer direct-fired heated MUA systems. These packages are designed to deliver tempered make-up air for installations requiring frequent air changes. Units are available for natural and propane gas applications, and for indoor or outdoor installation. Direct-fired is more efficient than indirect and many local utilities now have incentives to offset the initial cost of installation.

Proper Ventilation Is Essential

All cooking equipment must be allowed to "breathe". Proper air flow is required, not only for combustion, but to exhaust fumes and odors and prevent heat and moisture build-up in equipment controls. Too much exhaust can suck the heat out of an oven, preventing it from cooking properly. Too little can cause controls and electronic components to overheat and fail. Knowing what your cooking equipment requires is critical to its performance and operating life. So, proper ventilation can indeed have a major impact on your bottom line!

Another reason for proper and efficient ventilation is the need to maintain a somewhat negative pressure in the kitchen area – 20% is a general rule of thumb.

Negative pressure means drawing air into the kitchen space atmosphere to contain the odors and effluents that a foodservice operation produces. Kitchens that operate under a positive pressure have a tendency to push the cooking odors and effluents out of the kitchen and into the dining area. Have you ever walked into a restaurant that felt humid and smelled of food odors? This is unacceptable, especially in places of "shared common space", i.e. mall food courts, hotels and office buildings where the operator desires a facility with fresh air and no cooking odors.

I mentioned earlier that the system design depended on the type of cooking equipment being used. Although the type of equipment required for cooking is one factor, the use of kitchen space is another. Regardless of the source of make-up air, it is necessary that whoever designs your system calculate the make-up air required for your facility. This is directly related to the type of cooking you do (your menu items), your cooking equipment and related building restrictions. Some considerations when calculating make-up air and equipment required are:

• Minimize make up air velocities;

• Maintain a slight negative pressure in the kitchen to ensure that it is always neutral to the outdoors and that the dining rooms and rest of facility remains slightly positive to the kitchen;

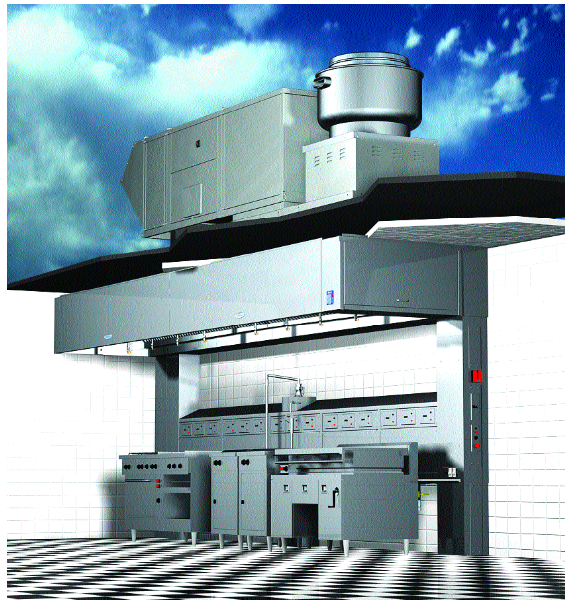
• Local code jurisdictions will prevail.

Simple Prescription for a "Sick" Hood

Earlier, I promised some suggestions for curing some of the problems common to many of the "as-built" hood systems in use today. Here are just a few:

• If you have a short circuit hood (integrated make-up air) you can improve the capture without increasing the make-up fan speed by moving your make-up to the back of the kitchen. Simply have your mechanical contractor redirect your make-up air so that it travels across the kitchen itself and you will see a dramatic improvement in your hood's performance.

• Incorporate the use of "side panels" that can be installed on the open sides of your present exhaust hood system. This will in effect create a larger "chamber" for the hood to draw from and improve your overall system efficiency. These panels can be made very economically from stainless steel or



Plexiglas.

• In the case of a wall or canopy type configuration, push your equipment back. This will allow for more overhang and increase the overall size of the "reservoir" to capture, contain and exhaust cooking effluent, heat and vapors. This essentially increases hood overhang, and the recent FSTC report, ASHRAE Research Project 1480, proved that increasing hood overhang is the best performance enhancement for island canopy hoods. And increased overhang can decrease the required amount of exhaust for a given hood cooking line.

Pre-Engineered Systems…

There are many manufacturers of commercial kitchen ventilation systems that produce a variety of hood designs available today. You may purchase a fully integrated package that is pre-engineered for optimum performance. For more information on ventilation systems for your restaurant, check out the Food Service Technology Center design guides at: http://fishnick.com/ventilation/designguides/

A properly designed and operating kitchen ventilation system will make your operation more employee and customer friendly and contribute to your overall bottom line! Remember, good ventilation is good for your business!

To learn more about how natural gas can benefit your foodservice operation, log onto the Gas Foodservice Equipment Network at www.gfen.com