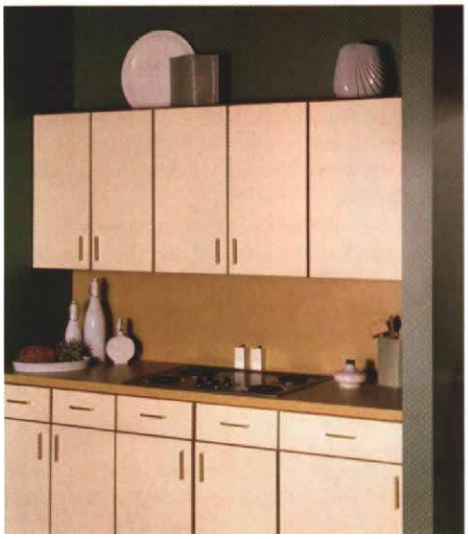
Venting the Kitchen

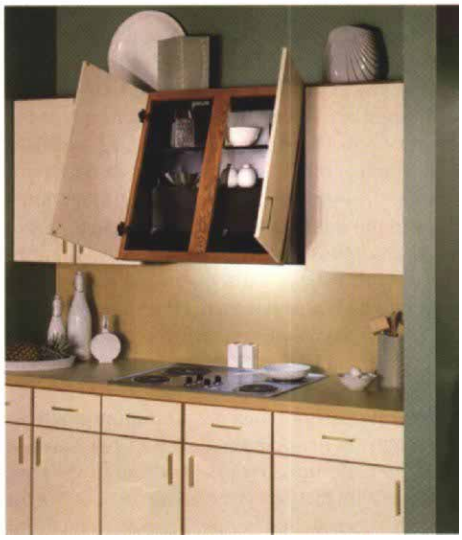
To expel kitchen moisture and grease efficiently, select an appropriate exhaust system and make the duct run short and straight

by Wendy Talarico

More heat requires more ventilation. Professional-style ranges generate more heat than residential cooktops, up to 15,000 Btus per burner. Larger hoods and more powerful exhaust fans are necessary to pull away heat and cooking effluent. Photo courtesy of Viking.

Concealed dual-purpose hood even offers storage space. The Hideaway system, a range hood mounted into a cabinet, activates the exhaust fan when the cabinet is tilted out over the range top. The hood is located inside the bottom of the cabinet. Photos courtesy of Broan.





My family once lived in a house in Buffalo, New York, that had no kitchen exhaust system. It wasn't much of a problem in summer. A stiff breeze off Lake Erie whisked cooking odors, heat and steam out the window. But in winter, when cooking made the house smell like a crowded apartment building, we cranked open foggy kitchen windows and let the arctic winds draw the odors—and the heat-outside.

If you've ever lived without kitchen ventilation, having it may seem like a luxury. Kitchen exhaust systems go a long way toward improving air quality throughout a house, however. They suck out odors and heat and get rid of the grease and moisture generated by cooking. They also remove noxious by-products of combustion from natural-gas ranges and some types of indoor grilling. Exhaust systems are invaluable in cooking accidents, too.

There are two types of kitchen ventilation: intermittent and continuous. Range hoods and downdraft ventilators—switched on as needed-are examples of intermittent systems. These types of units move a large amount of kitchen air relative to the second type of system, which is a continuously running whole-house exhaust fan, or multipoint system, sometimes referred to as background ventilation. (A multipoint system is not a heat-recovery ventilator, although multipoint HRVs are available.) A multipoint system typically has a kitchen intake and often contains a device that lets the user turn up its exhaust capabilities during cooking.

There's lively debate among indoor-air-quality specialists and manufacturers about the amount of ventilation needed in the kitchen and about the best-working systems. Some professionals prefer intermittent fans because of their location at the range, which is the origin of the problem. But because dishwashers, garbage cans, refrigerators, coffee makers and other appliances generate unpleasant smells, vapors and excess heat, some professionals favor continuous systems. A third group advocates both intermittent and continuous exhaust fans, especially for installation in tightly built homes.

Oddly enough, no state or national code that I know of requires a downdraft ventilator or an exhaust hood in the kitchen. Only two states, Washington and Minnesota, require mechanical ventilation in the house, although neither specifically references the kitchen. The American

Society of Heating, Refrigerating and Air-Conditioning Engineers' (ASHRAE) Standard 62, which provides ventilation guidelines referenced by state and local codes, says an operable kitchen window is plenty of ventilation. If there is no window, however, ASHRAE 62 offers minimal mechanical-exhaust guidelines.

This article focuses on range-hood and downdraft exhaust fans because these fans are the most common forms of kitchen ventilation. Before heading down to the local home center with your checkbook, however, it's first important to understand how these fans work, what their performance characteristics are and how to install them without diminishing performance.

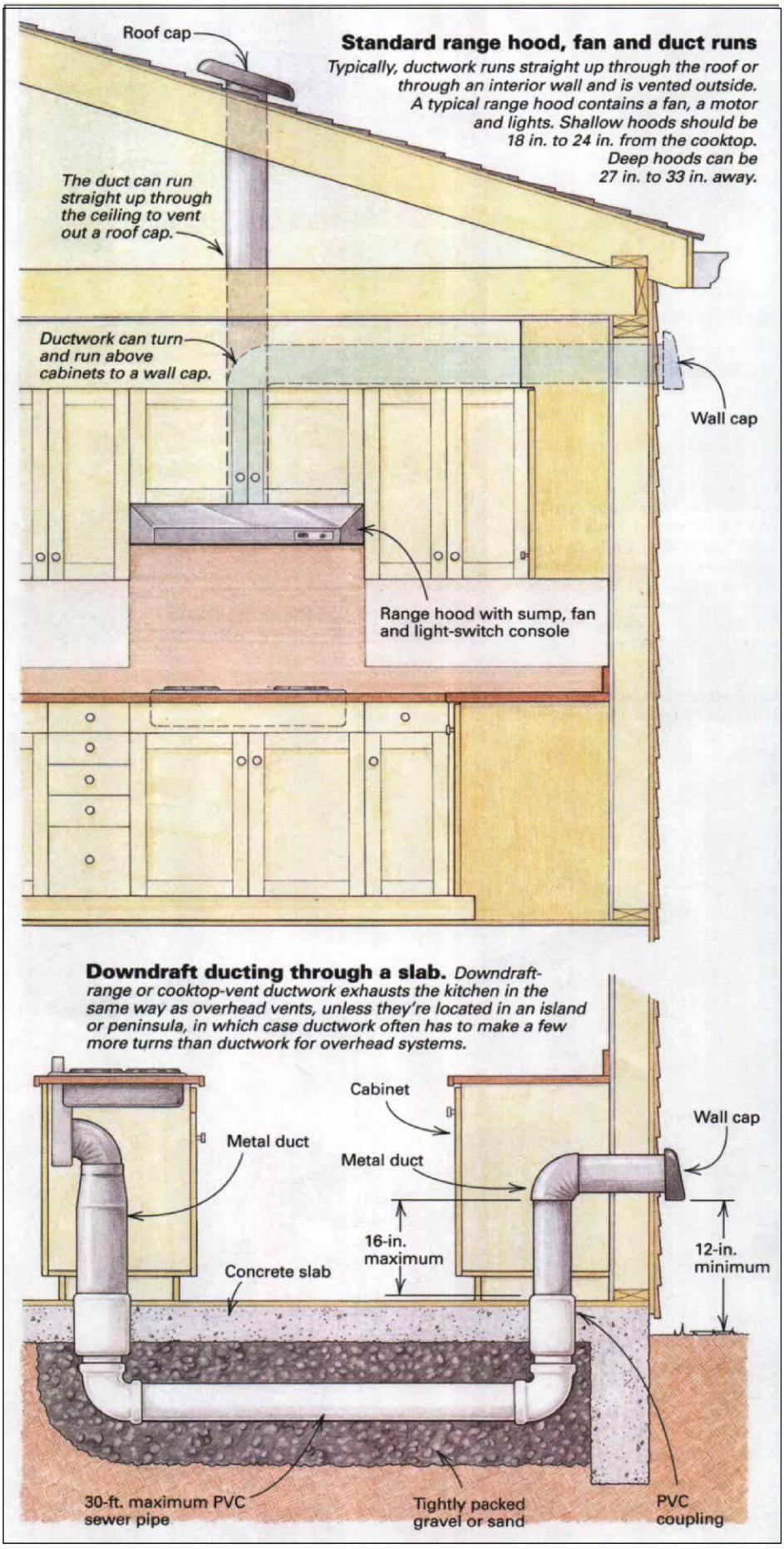
Exhaust fans should match the amount and type of cooking—Air movement is rated in cubic feet per minute (cfm). Range hoods and downdraft systems move anywhere from 100 cfm to 1,800 cfm. The Home Ventilating Institute (HVI), a trade group that works with an independent laboratory to rate ventilation equipment, recommends a minimum of 40 cfm per linear foot of hood. For an average 30-in. wide hood (the same width as most stoves), that means at least 100 cfm. The National Kitchen and Bath Association (NKBA) says this number is skimpy. Its technical manual suggests a minimum of 50 cfm to 70 cfm per linear foot, or 200 cfm for a 30-in. hood.

Special equipment requires special ventilation. The NKBA recommends at least 600 cfm for an open grill or barbecue. Stronger ventilation is necessary for users of commercial ranges (top photo, facing page). Burners on these units generate upward of 15,000 Btu. (A standard household-range element rates only about 6,000 Btu.) The exhaust system must pull excess heat, combustion by-products and vapors out of the kitchen. Fortunately, companies that make professional-style exhaust hoods recognize that homeowners aren't always cooking enough to feed an army of guests, and most of them make their fans adjustable.

Systems that exhaust high volumes of air can create problems. They take a lot of electricity to run, and because they remove so much indoor air, they waste heating and cooling energy. In tightly built houses, exhaust systems, especially those in excess of 600 cfm, can cause backdrafting. This condition occurs when a house is depressurized and toxic combustion gases are sucked from the furnace or water-heater chimney into the living space. For that reason, it's important to think of the entire house as a system and to evaluate all exhaust appliances before settling on a ventilation system for the kitchen.

Size, quality and location of fan determine how noisy it will be—The noise a fan makes is measured in sones. To get an idea how loud 1 sone is, sit in a quiet kitchen and listen to the refrigerator hum. That's about the equivalent of a sone. Most fans generate between 3 sones and 8 sones, depending on how many cfm they're pulling and how well-built they are.

Manufacturers certified by the HVI sometimes provide sone and cfm ratings in their product lit-



Drawing: Heather Lambert

The hood is in the shelf. This space-saving range hood is built into the shape of a shelf that holds a microwave oven. The fan and motor are located behind the microwave. Two openings reach well out over the range top to draw cooking vapors away from the kitchen.

Hood slides out to cover most of the range. Slide-out range hoods stay hidden beneath cabinet doors but slide out a foot and half.

erature. Otherwise, the information can be obtained from the company. The ratings can be misleading because the number of cfms varies from kitchen to kitchen, depending particularly on the length and size of the ductwork. The number of sones also varies at the point of installation. Remote systems, including exterior-mounted fans, remove the noise from inside the kitchen.

Measurements also don't take into account the high-pitched whir of air moving through a hood's filter, which to some may be more annoying than the noise of the fan. As a rule, the noisier the system, the less likely people are to use it.

The heart of the system is in the hood— Before examining the various configurations of range hoods and their effectiveness, let's eliminate recirculating hoods from consideration. These units are the least expensive and least effective of all range hoods. They require no ductwork because they merely pull cooking effluent through a filter and then blow the cleaned air back into the room.

The exterior, or shell, of the average hood is light-gauge steel of 20-plus ga., although high-end hoods are 18-ga. to 16-ga. steel. (The lower the gauge number, the stronger the steel). If you tip a hood upside down, you'll notice the shell forms a hollow area, the sump, where cooking by-products collect (top drawing p. 57). The deeper the sump, the more cooking effluent it collects. Sumps in professional hoods are deeper than most, as much as 24 in. Residential hoods are shallower, and slide-out units have sumps of only 1 in. or 2 in.

Under the hood you'll also see a mesh filter that prevents grease from invading the ductwork. Although most filters are flimsy and allow much of the grease to pass, better quality hoods incorporate sturdier, higher quality filters that do a better job and don't bend readily during handling. These filters also fit more tightly so they won't rattle, leak or whistle when the air is drawn through them.

Some range-hood manufacturers, including Vent-A-Hood Ltd. (for address see sidebar, facing page) and Viking Range Corporation (P. O. Drawer 956, Greenwood, Miss. 38930; 601455-1200), shun the filter altogether because it makes the fan noisier and diminishes pulling power. In place of a filter, their hoods remove grease from the air using a patented process that cools the air by spinning it so grease condenses and sticks to the fan housing. The housing is detachable and washable. (Vent-A-Hood and Viking use filters on exterior-mounted hoods.) Depending on the amount of cooking that is done in a kitchen, the filter or housing should be cleaned at least twice a year.

The fan and motor are tucked behind the filter. Low-end models use propeller fans, but others use one or several squirrel-cage blowers. The latter are both quieter and more efficient. To achieve high cfm ratings, some hoods incorporate two, four or even six blowers, which are sometimes independently switched so a blower can correspond to a specific burner on the stove. Some companies mount the motor on a neoprene base that absorbs vibration. You can

Photos this page: Courtesy of Broan

mount fans in crawlspaces or attics, on a roof or on an exterior wall, which means they draw air instead of pushing it through the ductwork. These remote-mounted units are more expensive because the fan and motor must be protected from the elements, and they require more power to pull air through the duct run. But for quietness, a remote system can't be beat.

Codes don't always require dampers, though most manufacturers include at least one at the duct connector to keep outside air from blowing into the house through the exhaust unit. A second damper, located at the wall cap or roof jack, is additional insurance against drafts.

Range hoods can blend in or stand out— There are two approaches to range-hood aesthetics: Make the hood blend with surrounding appliances and cabinetry, or let the hood make its own statement. Judging by what manufacturers offer, most people prefer the first route, although some companies do a brisk business in custom hoods (sidebar right).

A lot of exhaust hoods hide behind other kitchen items, such as cabinetry or microwaves. Here are some examples:

· Pull-out hoods look like another set of cabinets until cooking time (bottom photos, p. 56). When the bottom is tipped out, the light and the blower turn on automatically. The hood is actually inset into the bottom half of the cabinet, and the top of the cabinet remains open for storage.

· Broan (926 W. State St., Hartford, Wis. 53027; 414-6734340) makes a hood that doubles as a microwave shelf (top photo, facing page). The fan and motor are housed behind the microwave. Two openings beneath the shelf serve as ducts to move effluent into the system.

· Slide-out units, offered by KitchenAid (Sparks Administration Center, 701 Main St., St. Joseph, Mich. 49085; 616-9234600) and other manufacturers, consist of a sliding panel that's pulled from beneath over-the-range cabinetry to expose the louvered opening (bottom photo, facing page). The fan and the motor are in a sheet-metal housing that's hidden behind the cabinet doors above. The panel slides out about 18 in. and covers most of the range top.

Downdraft systems offer discrete performance—Hoods tend to stick in your face while you cook. So about 30 years ago, manufacturers introduced downdraft ventilators (photos p. 60). These types of systems give the range top a smooth, streamlined look and open more space for cabinetry above the range. If ranges are installed in kitchen islands, downdraft ventilators also allow unobstructed views of and from the island. But their real advantage is they take the exhaust system—and its attendant noise—out of your face.

Downdrafts can be integral to the cooktop, in which case the intake usually sits in the center, or you can add downdrafts to the sides or the back of the range. Rear-mounted exhaust systems are normally flush with the range top but can rise mechanically to a height of 8 in. or 9 in. In some cases, that height is variable so if you're just simmering a short pot on a back burner, you can

Custom Range Hoods: High-End Kitchen Ventilation

Serious cooks, and serious aestheticians, want a serious range hood custom designed to suit their needs. They can get the range hoods that they want from an architectural sheet-metal shop—or from one of several companies that specialize in making custom hoods, including Abbaka (435 23rd St., San Francisco, Calif. 94107; 415-648-7210) and Vent-A-Hood (P. O. Box 830426, Richardson, Texas 75083-0426; 214-235-5201).

Abbaka, which also deals in imported range hoods, got into the custom-hood business about two years ago. Their one-of-a-kind designs, including one that looks like the Millennium Falcon from *Star Wars* and another, a giant cylinder, that looks like a *Star Trek* transporter tube (photo below), start at about $3,000 and climb steeply from there. Most of the company's design ideas come from clients or their architects. The sketches arrive crude and crumpled or fresh off a CAD system and may be interpreted in a variety of metals, ranging from 16-ga. mirror-polished stainless steel to pure copper. To date, the largest hood was 8 ft. across and pulled 2,200 cfm. Below were a range, a deep-fat fryer, a dedicated wok burner and a barbecue.

Vent-A-Hood also will make range hoods in custom size or shapes. Ed Gober, national sales manager for the company, said Vent-A-Hood can make a hood for any custom design.

Gayle Olsen, a kitchen designer with Ducci Kitchens in Torrington. Connecticut, said any good sheet-metal company should be able to fabricate a hood from a customer's design. The design and final product need to meet the local building code and be properly sized for filters and fan, she said.—*W. T.*

High-tech range hood reminiscent of *Star Trek*. Cylindra is a shining example of high-end custom range hoods.

Photo this page: Courtesy of Abbaka

raise the pop-up to just 2 in. or 3 in. A louvered intake protects the top or front of a downdraft ventilator. The fan pulls air down through a mesh filter into a plenum. The squirrel-cage blower (or blowers) and motor are set beneath the range. As with most hoods, there's usually a damper at the connection to the duct run. The duct itself runs beneath the floor or along the cabinet kick space and either up the wall or out at the foundation. You can mount downdraft fans outside the house for quietness.

To understand the differences in how hoods and downdraft units work, you have to remember that hot air, even when it's carrying moisture and grease, is lighter than cool air. It rises. Hoods capitalize on this basic principle. When the plume of cooking effluent rises, the hood holds it until the fan can evacuate it. Downdrafts have to work harder because they have to overcome the physical properties of hot air. Also, because they don't have a hood to hold the cooking by-products, downdrafts must rely on velocity, or higher cfm, to pull air down and out. Because of that reliance and because pop-up units require more moving parts and a motor that raises and lowers the unit, downdrafts are more expensive than comparable range hoods.

Performance depends on the proper sizing and placement of the ducts and hoods—The University of Minnesota's Cold Climate Building Research Center conducts some of the most thorough studies on the performance of various kitchen exhaust systems. Researchers tested the pulling power of exhaust units by using optically dense water-vapor fog and steam so they could photograph airflow and trace capture abilities of different fans.

Pop-up vent is there when you need it. Rear-mounted downdraft units hide inside the range top until you need them, then pop up at the press of a button. Their pop-up design gives them better capture abilities than the conventional, flush-mounted downdraft ventilators.

Among other things, the study found that for a ventilation system to perform well, workers must install it correctly. Galvanized steel ducts should be at least as large as the manufacturer recommends, and runs should be as short and as straight as possible. Leaks, elbows and connectors also compromise performance. It's best not to use flexible duct because it creates back pressure and air turbulence. Also, grease is easily trapped in the spiral ribs.

Properly sized wall-mounted hoods are the most efficient (top photo, p. 56). Side baffles—sheets of metal or glass that extend down from the sides of the hood to the range and project at least 12 in. from the rear wall—help the fan perform even better because they further contain contaminants. These baffles aren't readily available through manufacturers. You can, however, make your own baffles if you're building a home for someone sensitive to gases and odors.

The hood should cover the entire cooking surface and extend 3 in. beyond both sides of the cooktop. According to the research, for instance, a range that's 30 in. wide should have a 36-in. wide hood. The depth of the hood's sump, or holding area, determines its distance from the cooking surface. Shallow hoods should be 18 in. to 24 in. from the surface of the cooktop. If they're any closer, they get in the way of cooking; if they're farther away, their capture ability is compromised. Deep hoods can be 27 in. to 33 in. from the range.

Different types of hoods, including slide-out and tilt-out varieties, generally are most effective when the homeowner does most of the cooking on back burners. Air intakes are at the rear, and the hoods aren't deep enough to cover the entire range. Unfortunately, homeowners are not likely to restrict their cooking to back burners.

Among downdraft ventilators, pop-up units at full height perform well when pulling pollutants from pots and pans, even tall ones, set on back burners. They also pull well from low pans set on front burners. Their capture rate for tall pots on front burners is poor, even with the fan on its highest setting. Flush units successfully remove effluent from pots and pans shorter than 3 in., but even the most powerful units capture little rising from pans more than 3 in. in height, such as woks or Dutch ovens.

Fans mounted on the exterior are less efficient on hoods and downdraft units because they draw air through ductwork and encounter resistance before they even begin to pull away cooking by-products. They also draw air from leaky areas along the run so that well-sealed joints are even more important.

The results of the studies, says Wanda Olson, an associate professor and housing-technology specialist at the University of Minnesota, indicate it's essential that builders work with homeowners to evaluate the amount of cooking they will do and the kind of kitchen equipment that will suit their needs. From that information, builders can determine what type of exhaust system will work best. "A downdraft isn't practical for a family that does a lot of cooking or one that uses lots of tall pots to cook pasta, just as a commercial hood isn't necessary for couples," she says.

Photos this page: Courtesy of Broan

Homeowners should discuss these factors long before a house or renovation project is under way, she adds.

Correctly installed ductwork maximizes exhaust and minimizes problems—Ed Gober, national sales manager at Vent-A-Hood, tells a story about a $4,000 range hood his company designed for a $2 million house near Philadelphia. Gober later received a call from the homeowner, who said smoke was backing up into the kitchen. When he visited the site, Gober found the builder had run the ductwork under one beam and over another, reducing the duct from 8 in. to 6 in. in the process. So despite a powerful set of blowers, the exhaust air couldn't make it through the maze of ductwork and instead flowed back into the kitchen.

"The most important advice I can give the builder, the remodeler, the kitchen designer or the architect is to think ahead-during the design stage is best—about where the ducts will run," Gober says. That's particularly true when installing a high-cfm unit that requires extra-large ducts, dual ducts or a downdraft system that's routed through a slab (bottom drawing, p. 57).

In planning the ductwork, it's important to limit the run to 30 ft. or less in length and to minimize twists and turns. Elbows and transitions restrict airflow, which means that each elbow equals about 5 ft. to 10 ft. of duct run while transitions equal about 1 ft. to 5 ft. (sidebar right). You could, for instance, have two elbows and 15 ft. to 20 ft. of duct run without significantly affecting airflow. Anything longer would require advice from manufacturers, most of which maintain technical departments that can give you the help that you need.

It's good to follow manufacturers' recommendations in choosing the correctly sized ductwork. You can use a size 1 in. or 2 in. larger than what's recommended, but never smaller. Exhaust systems as large as about 600 cfm work fine with 3¼-in. by 10-in. or 7-in. round ducts. Higher cfms require larger ducts. Hoods with multiple blowers may require 6½-in. by 8-in. or 12-in. round ducts, or dual 8-in. round or 3¼-in. by 14-in. ducts. You should never downsize ductwork midrun.

Manufacturers recommend wrapping ducts that pass through unconditioned airspace with 1 in. of fiberglass insulation to prevent condensation. The NKBA recommends adding insulation along the 3 ft. of duct adjacent to an outlet because cool air is likely to seep in.

If you're replacing an old system, make certain the existing ductwork is vented to the outside and that the ducts are the correct size. Reseal the joints with tape or silicone sealant, and make sure you've insulated ductwork where necessary.

Use common sense in locating the end cap. If it's on the wall, make sure kitchen fumes aren't blowing over the deck or the patio or into a window (although codes require that caps be a certain distance from windows). If you're venting from the roof, pick a place where the end cap isn't noticeable from the street. □

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Duct fittings impede airflow

Manufacturers recommend that duct runs be as short and as straight as possible and that the maximum length be kept to around 30 ft. or less. Turns, transitions and connectors create resistance and impede the flow of air through ductwork. The resistance of a duct fitting is measured in terms of equivalent length, so air flowing from a 6-in. duct through a 90° rectangular elbow encounters air resistance equal to about 4½ ft. of straight duct run. Shown below are the equivalent lengths of various standard duct fittings.

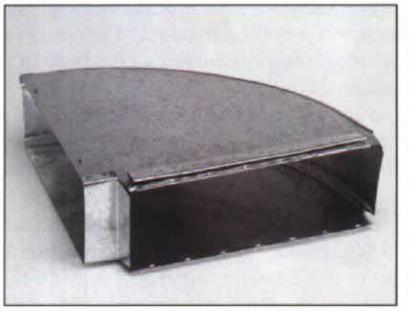
90° elbow=5 ft.

45° elbow=2.5 ft.

45° vertical angle=5 ft.

90° vertical angle=5 ft.

Wall cap=0 ft.



3¼-in. by 10 in. flat elbow=12 ft.

6 in. to 3¼ in. by 10 in. transition=4.5 ft.

6 in. to 3¼ in. by 10 in. 90° elbow=9 ft.

Photos this page: Sloan Howard