



# Whole-house Fans for Summer Cooling

## Save energy and money

A whole-house fan can help keep a house and its residents cool during spring, summer, and fall. On mild days, a homeowner can save energy by cooling their house with a whole-house fan instead of using central air conditioning. A whole-house fan pulls cool outdoor air inside, and keeps it moving through the house. Typically, a whole-house fan uses about one-third as much electricity as a central air conditioner, and can save as much as \$70 per month (based on 2.5 tons of air conditioning and 10-cent electricity). Many people report considerable savings with a whole-house fan, but say they operate air conditioning two or three weeks per year during the hottest, muggiest weather.

## Whole-house fans cool three ways

Whole-house fans are large, powerful fans that pull air through the house. Usually these are 20-48 inches in diameter and are powered by one-quarter to one-half horsepower electric motors. These often are located in the ceiling of the upper story and exhaust air from the house into the attic. These fans cool a house by:

- Pulling cool outdoor air into the house through open windows. This cool air quickly replaces hot air in the house.
- Moving drier air through the house. This creates a slight “breeze” that evaporates moisture from skin and makes people feel cooler.
- Exhausting hot air out of the house through the attic. This cools the attic and reduces heat gain through the ceiling.

A whole-house fan will keep the residents cool part of the time. Fans do not reduce temperature or humidity. When outdoor air is hot and moist, whole-house fans are not effective. They work best when the outdoor air is dry and cool. Often whole-house fans are used to cool houses in the evening after the outdoor air has cooled. In the morning, when the outside temperature rises above the temperature in the house, the fan is stopped and windows and drapes are shut. On many days, houses may stay fairly comfortable until evening, when the fan again can be used to cool the house.

If the temperature in the house during the day rises above the outdoor temperature, there are two choices.

- Open the windows and turn on the fan to keep the house at approximately the outside temperature. The moving air also will help cool people in the house.
- Close up the house and operate the air conditioning.

If you want to cool a particular room, fully open all the windows in the room to increase the air movement. To further increase the air flow in that room, shut windows in other rooms.

## Fan capacity affects cooling

The larger the fan's capacity, the quicker it will cool the house. The fan should be able to completely exchange all the air in the house every one-to-two minutes. Larger fans will increase comfort and lower the air temperature in the house to near the outdoor temperature in less than one hour. Larger fans are more expensive to purchase, install, and operate. But fans that are too small will not adequately cool the house.

If your house tends to be hot, consider a fan that can exchange the air every minute. Cooler houses can use a smaller capacity fan that can exchange the air every two minutes.

Fans are rated in cubic feet of air moved per minute (cfm). To determine the correct size fan for your home, first calculate your home's volume in cubic feet. Volume is determined by multiplying the floor area by the ceiling height. Here is an example.

- A single-story 30-foot by 40-foot home with 8-foot ceilings has 9,600 cubic feet ( $30 \times 40 \times 8 = 9,600$  cubic feet).
- The volume can be reduced because of unventilated areas such as closets. If you do not know the volume of unventilated areas, an acceptable reduction factor is 0.75. Thus, the volume to be ventilated in this example is reduced to 7,200 cubic feet ( $9,600 \text{ cubic feet} \times 0.75 = 7,200 \text{ cubic feet}$ ).
- To supply one air exchange per minute, the fan rating must be the same as the ventilated volume of the house, or 7,200 cfm.
- To supply one air exchange every two minutes, the fan rating must be half the ventilated volume of the house, or 3,600 cfm.

To ensure the fan can move the desired amount of air, choose one that has the Air Movement and Control Association Inc. (AMCA) program seal for air performance and/or the Home Ventilating Institute (HVI) certification. Compare cfm. specifications at 0.1 inch water gauge (0.1" W.G.) with the fan shutter in place. Free air (0.0" W.G.) ratings without the shutter in place, although higher, are less accurate as a guide for the conditions the fan will experience in your home. For electrical safety, the electrical components should be listed by Underwriters Laboratory (U.L.).

A variable speed or multi-speed fan is desirable. The lower speed can be used for general ventilation and quieter operation, while the fan will have reserve power to supply a stronger, steady breeze at high speed.

### **Install in a central location**

The fan should be centrally located, preferably in a hallway that opens to all rooms in the house. Choose a spot that provides plenty of overhead space in the attic to allow room for installation and air flow. Central hallways on the upper story are ideal. Do not place the fan in an individual room.

Installation requires cutting an opening into the ceiling and placing the fan in the attic above the ceiling joists. The fan requires electricity and adequate attic ventilation for the air that will be exhausted. Most manufacturers provide detailed installation instructions and have fans that can be installed over existing ceiling joists without cutting the joists. The installation is well within the capabilities of an experienced handy-person, but probably too difficult for someone who only occasionally does minor household repairs. All installation instructions must be carefully followed. Check local codes to be sure the fan is wired properly.

### **Control options are available**

The fans are supplied with simple on/off switches and motor speed controls. Optional controls include timers and thermostats. The timers allow you to manually start the fan and have it shut off automatically after a set time. The thermostats allow the resident to manually start the fan and have it shut off automatically when the house has cooled to a set temperature. Timers and thermostats are convenient, especially when the fan is used in the evening. These allow the resident to go to bed with the fan operating, and have the fan shut off during the night. Without a timer or thermostat, the resident might need to get up and shut off the fan if the house becomes too cool.

The resident must open windows and close fireplace dampers before turning on the fan. Always turn the fan on manually. Do not use controls that automatically turn the fan on.

### **Fans need attic exhaust venting**

Most whole-house fans blow the air from the house interior into the attic and out the attic vents. The amount of attic venting needed is specified in manufacturers' literature. Plan on approximately one-square-foot of unobstructed opening for each 750 cfm. rating of the fan. Large fans will require approximately 10-square-feet of opening. Screens or louvers reduce the unobstructed opening, so the rough openings will need to be approximately 50% larger, or about 15-square-feet for a large fan. It is preferable to have two or more openings on opposite sides of the attic. The openings may be windows, special openings cut into gables or dormers, openings between rafters under the eaves, or any combination of these. The oversized openings can be left open all winter if designed to prevent snow entry.

## Take safety precautions

A fan operating during a fire would provide oxygen to the fire, and spread smoke and flame throughout a house. To reduce that threat, install a fusible metal control link or a high-limit thermostat. The fusible metal control link would melt in the heat of fire, shutting down the fan and closing the shutters. On some models, fusible links are standard equipment, while on other models these are an additional, but low-cost, option. A high-limit thermostat would be activated by a fire's high temperature and would shut off the fan. Always install a fusible link or high-limit thermostat.

Also install a safety switch near the fan so you can turn off the fan when you service it. While performing any major servicing, such as oiling the motor, turn off the safety switch and interrupt the circuit at the fuse or circuit-breaker. Turn off the switch before winterizing the fan, and leave it off all winter.

Never operate the fan without opening the windows in the house. A fan operated in a closed house will be overloaded and could overheat. Also, the fan will create a high suction in the house that will back-draft combustion heating appliances, such as a gas furnace or water heater, or a wood or gas fireplace. The air pulled down the vent from these appliances could contain large amounts of dangerous gases, such as carbon monoxide.

Never operate the fan while using a wood or gas fireplace. The fan would pull gases and sparks into the room. Put out the fire and close fireplace dampers securely so soot and ashes are not pulled into the room.

## Winterize whole-house fans

The fan opening in the ceiling needs to be sealed for the winter. Otherwise, heated air from your house will rise and escape through the fan louvers into the attic. The louvers supplied with the fans commonly have felt seals, which are sufficient for summer sealing, but are not sufficient during the winter.

One way to seal the fan opening is to tape a vinyl (plastic) covering to the underside. Then, cut fiberglass insulation batts and place these in the fan chamber from the attic side. Although inexpensive and effective, this method requires installation and removal, and the plastic is not attractive in appearance.

Another option is to use an insulated cover supplied by some manufacturers. These covers might be installed either over the fan louvers on the house side or over the entire fan and housing on the attic side. Either method works well.

Some people have special covers custom-made to tightly seal the fan opening. These can be as simple or elaborate as desired.

Always shut off the wall switch and the safety switch before winterizing the fan. Never work around the fan blades until the electrical power is disconnected.

## Fans have advantages, disadvantages

Whole-house fans aren't for every house or to the liking of every homeowner. When using a whole-house fan, the resident must keep the windows open. Many people like keeping their house open. Others don't like the noise, dirt, and loss of security from open windows. Since the fan is pulling large amounts of air through the house, dust and dirt problems are increased. Window screens will collect debris from outdoors and need cleaning more often.

The whole-house fan does not remove humidity. Fan operation during high humidity conditions will bring moisture into the house, which could increase mold and mildew growth. Carpeting and household furnishings will absorb or adsorb moisture, which will require additional air-conditioning energy to remove.

However, if you want to keep cool during much of the spring, summer, and fall—without running an air conditioner—consider a whole-house fan.

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