

# Whole-house Fans for Summer Cooling

## Save energy and money

A whole-house fan can help keep you and your house cool during spring, summer and fall. On mild days, you can save energy by cooling your house with a whole-house fan instead of using your central air conditioning. A whole-house fan pulls cool outdoor air into, and keeps it moving through, your house. Typically, a whole-house fan uses about  $\frac{1}{3}$  as much electricity as a central air conditioner, and can save you as much as \$40 per month (based on 2  $\frac{1}{2}$  tons of air conditioning and 6¢ electricity). Many people report considerable savings with a whole-house fan, but say that they operate air conditioning two or three weeks per year during the hottest, muggiest weather.

IOWA STATE UNIVERSITY  
University Extension

Ames, Iowa

## and justice for all

The Iowa Cooperative Extension Service's programs and policies are consistent with pertinent federal and state laws and regulations on nondiscrimination regarding race, color, national origin, religion, sex, age, and handicap.

Cooperative Extension Service, Iowa State University of Science and Technology and the United States Department of Agriculture cooperating. Robert M. Anderson, Jr., director, Ames, Iowa. Distributed in furtherance of the Acts of Congress of May 8 and June 30, 1914.

Pm- 1437 | September 1991

## Whole-house fans cool 3 ways

Whole-house fans are large, powerful fans that pull air through the house. Usually they are 20 to 48 inches in diameter and are powered by  $\frac{1}{4}$  to  $\frac{1}{2}$  horsepower electric motors. They often are located in the ceiling of the upper story and exhaust air from the house into the attic. They cool a house by:

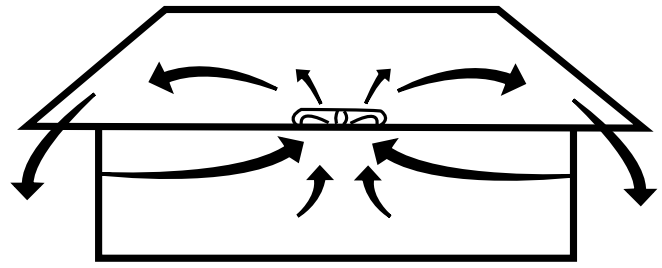
- pulling cool outdoor air into the house through open windows. This cool air quickly replaces hot air in the house.
- moving air through the house. This creates a slight “breeze” which evaporates moisture from skin and makes people feel cooler.
- exhausting hot air out of the house through the attic.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

A whole-house fan will keep you 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 all day long 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, you have 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 the 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.



**A whole-house fan pulls cool air in through the windows and exhausts hot air out of attic vents.**

## 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 1 to 2 minutes. Larger fans will increase comfort and lower the air temperature in the house to near the outdoor temperature in less than 1 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 2 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 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 ( $9,600$  cubic feet  $\times 0.75 = 7,200$  cubic feet).
- To supply 1 air exchange per minute, the fan rating must be the same as the ventilated volume of the house, or 7,200 cfm.
- To supply 1 air exchange every 2 minutes, the fan rating must be half the ventilated volume of the house, or 3,600 cfm.

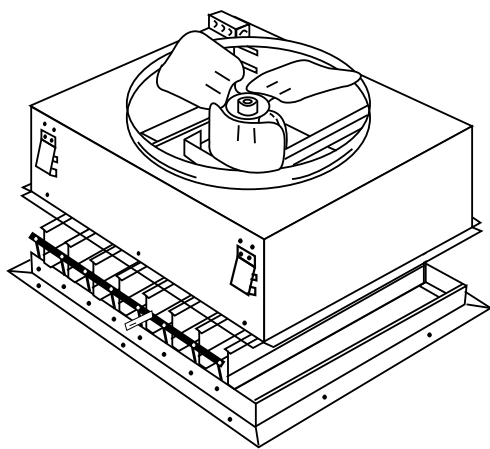
To ensure that the fan can move the desired amount of air, choose one that has the Air Movement and Control Association Inc. (AMCA) program seal for air performance and/or the Home Ventilating Institute (HVI) certification. Compare cfm specifications at 0.1 inch water gauge (0.1" W.G.) with the fan shutter 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 that 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



**Whole-house fans usually are 20 to 48 inches in diameter and are powered by ¼ to ½ horsepower electric motors.**

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 you 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. They allow you to go to bed with the fan operating, and have the fan shut off during the night. Without a timer or thermostat you might need to get up and shut off the fan if the house becomes too cool.

You must open windows and close fireplace dampers *before* you turn on the fan. So 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. Figure on approximately 1 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 percent larger, or about 15 square feet for a large fan. It is preferable to have 2 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 they are 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 they 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 that 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 heating appliances, such as the furnace, water heater, and 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 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

You need to seal the fan opening in the ceiling for the winter. Otherwise, heated air from your house will rise and escape through the fan louvers into the attic. The louvers that are 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 fiber glass insulation batts and place them 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 everyone. When you use a whole-house fan, you must keep your 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. 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 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.

Prepared by Tom Greiner and Shawn Shouse, extension agricultural engineers.  
Edited by Laura Sternweis, extension communication specialist.

File: Human Housing 9-2

Key words: agricultural engineering, engineering, energy, greiner-tom, shouse-shawn, housing, human housing, homes, cooling, fans, whole-house fans, ventilation.