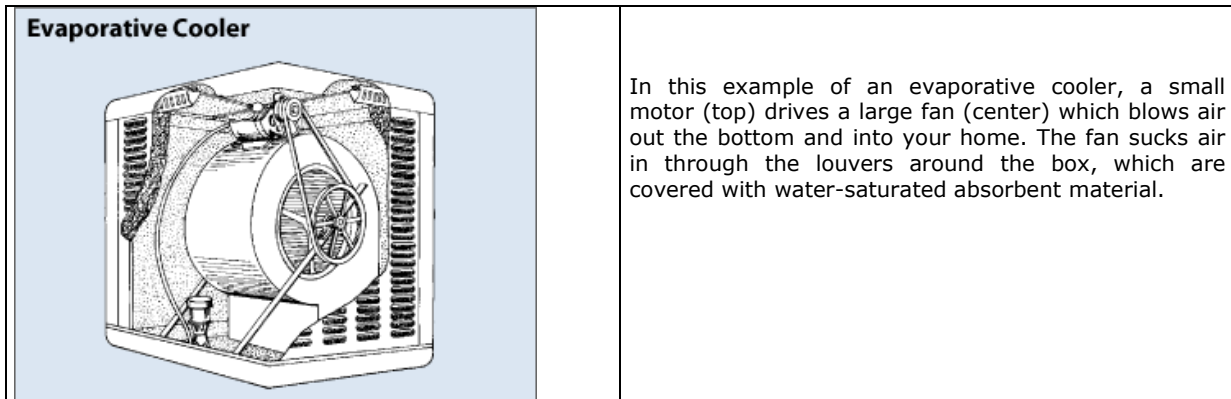


## EVAPORATIVE COOLERS



Have you ever noticed how cool it feels near a waterfall on a hot summer day? That's evaporative cooling: the reduction in air temperature that occurs when water evaporates. Evaporative coolers, commonly called "swamp coolers," use this effect to cool homes. They cool outdoor air by passing it over water-saturated pads, causing the water to evaporate into it. The cooler air is then directed into the home, and pushes warmer air out through windows. Evaporative coolers have a low first cost, use a lot less electricity than conventional air conditioners, and do not use refrigerants, such as chlorofluorocarbons (CFCs) and hydrochlorofluorocarbons (HCFCs), that can harm the ozone layer.

There are two types of evaporative coolers: direct and indirect. In a direct evaporative cooler, a blower forces air through a permeable wet pad. As the air passes through the pad, it is filtered, cooled, and humidified. An indirect evaporative cooler has a secondary heat exchanger which prevents humidity from being added to the airstream which enters the home. Evaporative coolers can be used as a sole cooling system in a home, as an alternative cooling system to a conventional refrigerant air conditioner, or in combination with a refrigeration system. However, conventional air conditioners should not be operated simultaneously with direct evaporative coolers, because air conditioners dehumidify while evaporative coolers humidify, and the two systems will work in opposition.

Evaporative coolers are sized based on cubic feet per minute (cfm) of airflow. Airflow for evaporative coolers is typically higher than conventional air conditioning systems : two to three cfm per square foot or three to four cfm per square foot in hot desert climates is typical. Improperly sized evaporative coolers will waste water and energy and may cause excess humidity or other comfort problems. Two-speed coolers are available that can handle varying cooling loads.

Unlike air conditioned rooms, windows or ceiling vents need to be open when an evaporative cooling system is operating. The large volume of fresh air added to the home replaces a significant amount of air that exits from the home. You can regulate both

temperature and humidity by opening windows in the areas you want to cool, and closing windows in unoccupied areas.

Many systems incorporate a bleed-off valve that purges water about every six hours. This leads to an additional five gallons of water used per hour, but may be necessary to avoid mineral build-up. Bleed-off valves are generally recommended.

Indirect evaporative coolers do not add humidity to the air, but cost more than direct coolers and operate at a lower efficiency. Two stage evaporative coolers combine indirect with direct evaporative cooling. This is accomplished by passing air inside a heat exchanger that is cooled by evaporation on the outside. In the second stage, the pre-cooled air passes through a water-soaked pad and picks up humidity as it cools. Because the air supply to the second stage evaporator is pre-cooled, less humidity is added to the air, whose affinity for moisture is directly related to temperature. The result, according to one manufacturer, is cool air with a relative humidity between 50 and 70 percent, dependent on the regional climate.

Evaporative coolers will not work well in humid climates - they will not cool air significantly and cause discomfort by excessive humidity.

Evaporative coolers are readily available through distributors mainly in arid regions, where they function well. However, they use a large amount of fresh water resources that are usually limited in these regions. Studies have shown that evaporative coolers use between 3.5 and 10.5 gallons of water per hour of run time. Systems that have a bleed-off valve use the most water.

Two-stage evaporative coolers force large amounts of outdoor air into a home, which may cause discomfort for people with allergies. Optional filters can be added to remove most of the dust from incoming air. Filters can also reduce the tendency of some coolers to pull water droplets from the pads into the blades of the fan. Most evaporative coolers do not have air filters as original equipment, but they can be fitted to the cooler during or after installation.

Regular maintenance is required, although the average homeowner can usually perform it. The more a cooler runs, the more maintenance it will need. In hot climates where the cooler operates much of the time, monthly maintenance is highly recommended. The pads should be replaced at least twice during the cooling season, or as often as once a month during continuous operation. Drip pans should be emptied and cleaned if the system is not in operation for an extended period time, because stagnant water can be a source of bacteria and mold growth.

Most evaporative coolers are roof mounted, but others are mounted through the wall or on the ground in a shaded area. Many experts prefer to install ground-mounted horizontal units, which feature easier maintenance and less risk of roof leaks.

Evaporative coolers are installed in one of two ways: the cooler blows air into a central location, or the cooler connects to ductwork, which distributes the air to different rooms. They can be adapted into existing ductwork or designed with dedicated ductwork. Dedicated ductwork is preferable, but not usually practical, because it requires higher airflows and larger ductwork than conventional heating and cooling ductwork. Air inlets should be located away from gas flues and exhaust fan vents, so that exhaust air is not pulled indoors by the evaporative cooler inlet.

A 4,500 CFM direct evaporative cooler, adequate for a 1,500 square foot home, would cost about \$800, installed. Installation is relatively simple and

total investment cost is less than air conditioning. Replacement parts are inexpensive compared with a conventional air conditioning system parts.



A two-stage evaporative cooler with a cooling capacity equivalent to a three-ton conventional system retails for about \$1,800, and total installed cost is estimated at about \$3,900. According to the manufacturer, installed cost is lower than conventional high efficiency air conditioners, and the units can condition a 1,700 square foot house in Sacramento, California during peak cooling season for less than \$30 per month (at 8 cents per kilowatt hour).

With evaporative cooling, a complete air change occurs every one to three minutes, offering a great health advantage over traditional refrigerated air conditioning, which recirculates house air repeatedly.

Compiled from :

[http://www.eere.energy.gov/consumer/your\\_home/space\\_heating\\_cooling/index.cfm/mytopic=12360](http://www.eere.energy.gov/consumer/your_home/space_heating_cooling/index.cfm/mytopic=12360)  
<http://www.toolbase.org/TechInventory/TechDetails.aspx?ContentDetailID=749&BucketID=1&CategoryID=6>

## Vocabulary

louvers = openings (see illustration)  
 pad = (thick) plate of absorbing material  
 sole = only  
 10 cubic feet = 0.28 cubic meters  
 10 square feet = 0.9 square meters  
 proper = suitable  
 ceiling : plafond  
 vent = a hole or pipe through which gases can escape  
 to bleed = to remove (air or a liquid) from a system in order to make it work properly  
 1 US gallon = ± 3.8 l  
 if sthg builds up, the amount of it that's present somewhere gradually increases

stage : étage (= étape)  
 to pick up = to absorb  
 related to = connected to, affected by  
 blade : pale  
 to own = to possess  
 drip pan = container used to collect liquid  
 mold : moisissure  
 shaded = not in direct sunlight  
 ductwork = ducts  
 dedicated = made / used for that purpose only  
 flue : cheminée  
 inlet : entrée  
 health : santé