Ventilation and Air Conditioning Systems[1]

"Ventilation," as defined by the 2004 Florida Building Code, is "the natural or mechanical process of supplying conditioned or unconditioned air to, or removing such air from, any space." "Infiltration" can be defined as the uncontrolled inward leakage of air through cracks and gaps in the building envelope. Notice that infiltration deals with *uncontrolled* situations. In our homes we want to be able to control air movement.

Ventilation and Indoor Air Quality

All homes need ventilation to remove stale interior air, pollutants, and excessive moisture. To accomplish this, researchers recommend mechanical ventilation systems for all buildings. The amount of ventilation required depends not only on the design of the building but also the number of occupants and lifestyle.

Spot ventilation in bathrooms and kitchens is one approach used to control moisture. Nearly all exhaust fans in standard construction are ineffective—a prime contributor to interior moisture problems in Florida buildings. The 2004 Florida Building Code requires that, where used, all bath and certain kitchen exhaust fans vent to the outside—not just into an attic or crawl space. General guidelines call for providing a minimum of 50 cubic feet per minute (cfm) intermittent of air flow for baths and 100 cfm intermittent for kitchens. Manufacturers should supply a cfm rating for any exhaust fan. Over-ventilation can cause unwanted air to be drawn into the home, leading to humidity and other problems. To allow for proper run times, consider installing a high-quality humidistat or timer. If noise is a concern, choose a fan with the lowest sone rating possible, 2.0 or less. (Noise is rated in *sones*.) Top quality models are often below 1.0; listen before you buy. Keep in mind that poorly installed fans can be louder than their rating would suggest.

Improving spot ventilation will help control moisture problems but it may not provide adequate ventilation for the entire building. A whole-house ventilation system may be another approach. Whole-house ventilation systems are usually classified as *exhaust ventilation* if the mechanical system forces air out of the home, *supply ventilation* if the mechanical system forces air into the home, or *balanced ventilation* if the mechanical system forces equal quantities of air into and out of the home. Each system has advantages and disadvantages. In Florida it is very important to avoid bringing hot/humid air into a building without proper dehumidification. A licensed heating, ventilation and air conditioning (HVAC) contractor should be consulted to help select and size the correct system for your needs. Ask several HVAC contractors for their advice before making your selection.

"Seal tight, ventilate right" implies that houses should be tightly sealed to reduce infiltration, and a whole-house ventilation system installed to provide fresh air and remove pollutants when and where needed in a controlled manner that does not negatively impact indoor environmental quality, building components or heating and cooling bills.

Air Conditioning

The size, efficiency and placement of an air conditioning system are all important. Equally critical is the air-conditioning contractor selected. The operating efficiency of a system relies on proper installation to achieve its performance rating. Keys to obtaining the designed efficiency of a system in the field include:

- Sizing the system for the specific cooling load of the building.
- Selection and proper installation of thermostats or controls.
- A ductwork system designed to deliver the correct amount of conditioned air to each space within the building.
- Sealing and insulating all ductwork.

Sizing and Dehumidification

Heating, ventilation and air conditioning load calculations have been required for new homes constructed in Florida since 1993. Chapter 13 of the Florida Building Code requires cooling and heating design loads be performed for each zone in a dwelling in accordance with "*ACCA Manual*

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[1]*DISCLAIMER – This piece is intended to give the reader only general factual information current at the time of publication. This piece is* ***not*** *a substitute for professional advice and should not be used for guidance or decisions related to a specific design or construction project. This piece is not intended to reflect the opinion of any of the entities, agencies or organizations identified in the materials and, if any opinions appear, are those of the individual author and should not be relied upon in any event. Applicable to 2004 Florida Building Code.*

J, ACCA Manual N or the *ASHRAE Cooling and Heating Load Calculation Manual*." (ACCA stands for Air Conditioning Contractors Association.)

The load calculations should be based on the exact area and type of construction for each component of the building envelope, as well as the heat given off by the lights, people, and equipment inside the building. If a zoned heating and cooling system is used, the loads in each zone should be calculated. An accurate load analysis will help to prevent problems that occur when a house is equipped with an oversized system.

Proper sizing includes designing the cooling system to provide adequate dehumidification. In Florida's humid climate it is critical to calculate the *latent load*—the amount of dehumidification needed for the building. If the latent load is ignored, the building may become uncomfortable due to excess humidity. Remember, comfort is a function of both temperature and humidity.

The Sensible Heat Ratio (SHR) designates the portion of the cooling load for reducing indoor temperatures (*sensible cooling*). For example, in a HVAC unit with a 0.75 SHR, 75% of the energy expended by the unit goes to cool down the temperature of indoor air. The remaining 25% goes for *latent heat removal*—taking moisture out of the air in the building. Systems that deliver less than 30% latent cooling may fail to provide adequate dehumidification in summer. If the designer of a HVAC system accurately estimates the cooling load, he or she will also calculate the desired SHR and thus, the latent load. The SHR is usually not listed in standard product literature, so make sure your air-conditioning contractor consults with the technical specifications for the particular model you are buying to ensure it will provide good moisture removal.

An oversized air conditioning system will cool a house too rapidly, which results in a short operational cycle and therefore minimal moisture removal from the dwelling. High humidity levels in the home can lead to occupant discomfort and problems with mold and mildew.

Equipment Efficiency

The cooling efficiency of a heat pump or an air conditioner is rated by the *Seasonal Energy Efficiency Ratio (SEER)*, a ratio of the average amount of cooling provided during the cooling season to the amount of electricity used. Federal regulation mandates a minimum SEER 13.0 for most residential air conditioners manufactured after January 23, 2006. Efficiencies of some units can be as high as SEER 17.0 or more.

The SEER rating is based on equipment performance in the Virginia climate. Some equipment may not produce the listed SEER in actual operation in Florida's buildings. One of the main problems has been the inability of some higher efficiency equipment to dehumidify buildings adequately.

If units are not providing sufficient dehumidification, the typical owner response is to lower the thermostat setting. Since every degree the thermostat is lowered increases cooling bills 3% to 5%, systems that have nominally high efficiencies, but inadequate dehumidification, may suffer from higher than expected cooling bills.

Equipment Location

Central heating and air conditioning systems have a component called an air handling unit or AHU. The advantages of placing the AHU in conditioned space include: it is in a more benign environment; a central location can minimize duct lengths and optimize air flow; there is easier access for maintenance; and any leaks occur in conditioned space.

Another often-neglected area of installation concerns the placement of the outside unit. Manufacturer's recommendations for proper clearance distances should be followed to ensure there is no blockage of air flow from the unit. Also, do not vent a clothes dryer within 10 feet of the outdoor unit as dryer lint will cling to the condensing coil, lowering both the system's efficiency and service life.

Proper Installation

Major components, such as the air handler and the condenser are joined together for the first time at the construction site. The efficiency and reliability of the entire system is directly related to the care and quality of the work that goes into the planning and installation of the complete system - including the ductwork.

Resources:

Florida Building Code www.floridabuilding.org

Southface Energy Institute www.southface.org

U.S. Department of Energy www.eere.energy.gov/buildings/info/documents/pdfs/26458.pdf

University of Florida *Energy Efficient Building Construction in Florida*, SP 267, Gainesville, FL.

Don't know where to go for an answer to a specific question?

Contact: Building A Safer Florida, Inc. toll-free 1-866-881-3221 or www.buildingasaferflorida.com

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