Green Building
construction details

chandler design build 919.304.5397

Achieving the 7.5 CFM per occupant balanced venting standard

Most third party certified green building standards require a designed fresh air intake strategy based on 7.5 cfm provided air per occupant. Here in North Carolina the outdoor air is often oppressively humid and we've eliminated many of the sources of indoor air contamination so I use a simple and inexpensive form of exhaust-only ventilation that gives me the fresh air I need when people are in the home but automatically scales back when they are gone.

If we are to provide 7.5 cfm per occupant then that means that we will need to provide 7.5 x 60 = 450 cubic feet per occupant per hour, the equivalent of a 110 CFM bath fan (running at 80 cfm actual) for 5.6 minutes. If the average individual spends 12 hours per day at home and 12 hours away from home we need to run that bath fan 5.6 minutes times 12 hours or 67.5 minutes per day to provide adequate fresh air for that occupant. If the house hold has some occupants such as teenagers or adult children who only occupy the home intermittently there should be a mechanism by which the house can dynamically respond to the variation in occupancy levels. Time delay occupancy sensors used as bath fans switches turn out to be an excellent way to allow the home to respond to varying occupancies with input from the homeowners. We set the master bath fan at a 45 minute time delay on the assumption that it will get triggered on average three times a day by two occupants, we put the kids bath fan on a thirty minute delay and the powder room on a 15 minute delay. This way if the kids are away at school there will be no additional ventilation since their bath will not see any use. If the adults both use the master bath at the same time every morning the fact that they count double will be compensated for by the longer off cycle and if there is a social event n the home and the powder room bath sees additional activity the house will automatically adjust for that additional occupancy. We use energy star rated 110 CFM Panasonic bath fans but any Energy Star rated bath fan will do. It is essential to have your energy star certifier verify the output of the fan to confirm the efficacy of your timer calculations.

Our goal is to provide balanced and filtered make-up air, with a designed exhaust and a balancing intake. Some builders put a filtered fresh air duct from the exterior to the return air duct going into the HVAC system but this makes the makeup air respond to the operation of the HVAC rather than the occupancy of the building. The home does not need additional make up air on the hottest and coldest day of the year. For a while Joe Lstiburek's Building Science Corp and Masco's System Vision program were using a FanCycler timer, combined with a 6" intake vent from the exterior to the return air manifold, to turn on the HVAC fan on a schedule to assure adequate ventilation. A good idea except that the homeowners tended to disable these devices according to Brian Coble at Advanced Energy who was in charge of that programs implementation (we designed his house and got to spend a lot of time talking building science with him as part of that.

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Some builders believe in "pressurizing the building" by constantly blowing a small amount of make-up air into the building but this doesn't take into consideration all the bath fans dryer vents and range hoods that have one-way pipes with exhaust only dampers leading to the outdoors. It is difficult to pressurize a home when the windows are open. Some builders rely on Energy Recovery Ventilators, generally using them in place of bath fans and this is a very valid solution if you can locate the filters in easily accessible locations and if your client can handle the $2,000 installed cost. But it is important to remember that the clothes dryer needs 200 CFM on average of make-up air and a range hood can need anywhere from 100 CFM to as much as 500 CFM and even a sealed combustion wood stove needs enough air to keep it from smoking when you are loading the wood. I also think that, in North Carolina at least, it's overkill. We know that the houses we build do have air leaks, on homes we test with tested air changes of less than 2 at 50 pascals depressurization (ACH-50) the passive intake vents typically provide 50 CFM for every 100 CFM removed from the house by the bath fans.

4 occupants at home
12 hrs/day = 3.8 hrs / day @ 100 cfm

Bring air into the laundry near the dryer
(NOT the return air vent on the HVAC)

Regardless of whether or not you have an energy recovery ventilator you still need a supply only filtered intake vent. We generally locate one in the laundry room, since the dryer is used much more than the range hood and we don't want to use conditioned air to dry clothes, and we undercut any door between the laundry and the kitchen and the wood stove at least an inch to provide air flow to these critical appliances. We used to use butterfly dampers to prevent this vent from back drafting but have switched to nylon sock dampers (see picture and supply info) these are more sensitive, durable, and don't make that irritating "tink tink" sound as they open and close. They also can be located directly in the wall in a horizontal orientation so they end up taking up less room in the installation. (Butterfly dampers need to be oriented vertically so they require an elbow and are a little more difficult to integrate into the cabinetry in the laundry room.) We use washable range hood filters located on the exterior of the house to keep pollen and insects from entering. Since we generally locate the intake damper under the laundry folding counter about 30" off the floor the exterior filter is usually about four feet off the exterior grade and very easy to access for inspection and cleaning. One cold climate builder told me he pulls his intake through a long section of six inch steel duct in his conditioned crawl to pre-warm the incoming air to keep from chilling down the laundry room too much in cold weather.

With green building's emphasis on eliminating sources of indoor air pollution such as bad carpet, formaldehyde, VOCs, high humidity levels, recycled rubber products and endocrine disruptors in flame retardants and vinyl plasticizers there is good cause to believe that the ASHRAE 62.2 standard should be reduced for green certified buildings. If I can use really good and quiet bath fans, a few $50 occupancy sensors, and add an extra 70 CFM bath fan in the sealed crawl to maintain constant airflow from the living space, down through the crawl to the outdoors then I've achieved my indoor air quality objective for a fraction of the cost of the ERV and can use that money for more comprehensive air sealing.

Sources of supply: R.E.Williams Industrial Supply (http://www.rewci.com)
Panasonic fan lite at $149.00 (http://www.rewci.com/pafvfabaexfa.html)
Cape Back draft damper $21.50 (http://www.rewci.com/noname6.html)
Delay fan switch $35.00 (http://www.rewci.com/fandetisw.html)