TECHNICAL ARTICLE

New California Energy Codes Incorporate ASHRE Indoor Air Quality Ventilation Standards

By Skip Walker September 2010

Ever since the introduction of the first energy codes back in the 1970's, the drive has been to build ever tighter buildings. With each code cycle, the requirements for weatherstripping, caulking, sealing, insulation, vapor barriers, etc. became more and more strict. The codes encouraged moving gas burning appliances outside the conditioned air envelope. The goal was to reduce air leakage so we could minimize the need to condition the "new" air infiltrating the building envelope.

The consequence of "trapping" stale,damp air inside the habitable spaces has been a significant reduction in indoor air quality. As we 'tightened" up the building envelope, we have seen a corresponding increase in mold-related issues. The addition of vapor barriers and other measures have reduced the ability of the building envelope to dry out when moisture infiltration occurs. As building sciences expert Dr. Joe Lstiburek says, "Wet happens...".

Older materials that performed well in leaky construction fail when integrated into tight envelope construction. Worse, many modern materials are intolerant of moisture and can fail when exposed to even modest amounts of moisture. All of this exacerbates indoor air quality issues.

Purposeful ventilation is a necessary component in maintaining indoor air quality. To manage air quality, one must first control the flow of air both into and out of the building. Then "new" air must be introduced into the dwelling in a thoughtful manner. It is now recognized that operable windows alone are simply not sufficient to maintain ***consistent*** indoor air quality.

Maintaining acceptable indoor air quality in tight construction cannot be achieved in an energy efficient manner by controlled ventilation of the building alone. Just as important is controlling contaminant/pollutant sources. This entails the use of exhaust fans at contaminant sources, primarily at bathrooms, kitchens. Beginning with the CMC 2007, bathrooms with tubs or showers were required to have an exhaust fan. This was a step towards introducing controlled ventilation at primary contaminant sources. Beginning with the next code cycle, kitchen exhaust fans will be required and internally vented/charcoal filter types will no longer allowed. This will add controls at another primary containment source.

Oddly, the last code cycle altered the definitions used to determine when combustion air could be taken from the conditioned areas. These changes effectively made it easier to derive combustion air from inside the conditioned areas. Personally, this seemed counter-intuitive, since the air inside the conditioned space is the most "expensive" air we own. We have already expended energy to temper it for human comfort. To then use it for combustion air seems a waste of resources. Yet, the practice is allowed. Additionally, all gas burning appliances inside the living space will bleed some contaminants off in the normal operation of the appliance. This is especially problematic in buildings with large exhaust fans, such a commercial style kitchen hoods, that create significant negative air pressure when operated. The gas appliance contaminants, whether they be trace amounts of aldehydes, carbon monoxide, unburned hydrocarbons, etc. all contribute to a reduction in overall indoor air quality. Moving gas burning appliances and combustion air intakes outside the conditioned air envelope are an important step in reducing air contaminant sources. It is unclear as to how and it this issue is addressed in the coming 2010 code cycle.

Over the past few years, introduction of make-up air into the living space has been accomplished primarily using central fan integrated systems. In these systems, outside air is introduced into the return air plenum. Older systems may or may not include an air filter, air balancing damper and motorized damper. In my market area, I generally only see make-up air systems installed in the warmer climate areas and then only on newer systems with AC. These are fairly simple systems intended only to allow replacement air into the living areas when exhaust systems, such as bath/kitchen exhaust fans, clothes dryers, etc. are operated. These systems do not address consistency in the indoor air quality because they can only bring in "new" air when an exhaust fan is running.

In this type of installation, the exhaust sources create a negative air pressure condition inside the building envelope. The negative air pressure then draws make-up air in through the make-up air intake. In newer installations, motorized dampers may be installed that only open when the forced air unit air handler fan is running. This type of system tends to limit make-up air introduction except when the main air handler is running.

Beginning with the 2010 code cycle, we will see the codes reference ***ASHRAE 62.2***, ***Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings***, as the basis for ventilation strategies and indoor air quality. ASHRAE applies only to 1-3 story above grade single and multifamily dwellings. It does not apply to commercial or transient housing, such as hotels.

Conformance with ASHRAE 62.2 does not guarantee "good" indoor air quality. The standard does not does not measure contaminant levels of the outside or indoor air. If outside air is contaminated or if a condition exists inside the dwelling that generates atypical contaminant levels, ASHRAE 62.2 is not designed to address those issues. The standard deals with minimum ventilation standards to achieve acceptable indoor air quality under normal conditions.

ASHRE 62.2 recommends controls on contaminant sources. The standard also recommends controlled ventilation based on the number of occupants and the gross living area of the dwelling. The standard allows several different models to achieve the ventilation requirements. There is a mechanism for applying the standard to older dwellings as well. To minimize the energy loss when new air is introduced into the living space, we will see an increase in the use of energy transfer mechanisms such as Heat Recovery Ventilators (HRV) or Energy Recovery Ventilators (ERV).

Heat Recovery Ventilators (HRV) provide thermal tempering of the air using a heat exchanger. Energy Recovery Ventilators (ERV) provide both thermal and moisture tempering of the air. Do to higher costs, ERV's would only be economical in extreme climate areas. Both systems use the exiting condition air as a tempering source.

Fantech HRV Installed & With Access Cover Open – Photo Courtesy Douglas Hansen

Compliance with the ventilation requirements can be achieved using one of three basic methods; Supply Systems, Exhaust Systems and Balanced Systems.

<u>Supply Ventilation Systems:</u>

Supply ventilation systems generally use a single intake. Air is generally distributed using either a dedicated ducting system or is integrated into the existing HVAC ducts. Supply systems rely on air ex-filtration through building envelope leaks, exhaust fan ducts, gas appliance vents, chimneys, etc. The tendency in supply systems is to pressurize the building. Positive interior air pressure can result in exterior wall condensation issues in cold climates. Positive pressure will help mitigate gas appliance back-drafting issues, radon entry and reduces moisture condensation in exterior walls cavities in hot, humid climates. Due to the design of the system, the supply air can be filtered. However, the use of heat recovery systems is not possible with supply ventilation systems. In supply systems, the incoming air may be supplied to the living areas untempered. This can create comfort issues where outside air is either very warm or very cold.

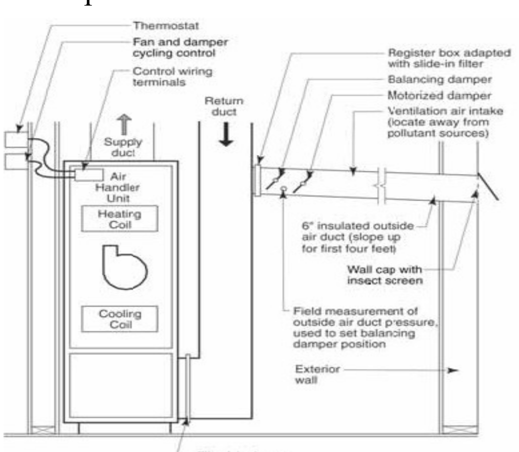

Illustration Courtesy Building Sciences Corporation

Exhaust Ventilation Systems:

In exhaust systems, there is usually a central exhaust fan. Intake air is supply through air infiltration in the building envelope, open windows, designed openings, etc. The interior will tend to be depressurized with an exhaust system. This can aggravate gas appliance back-drafting and radon infiltration. In hot, humid climates, there is an increase condensation issues in the exterior wall cavities. Exhaust systems do allow for the use of HRV/ERV's to conserve energy. Intake air sources are generally spread throughout the dwelling, so comfort issues are generally minimized. In designed opening systems, air filtration may be possible. In systems relying on building envelope infiltration alone, air filtration is not possible.

Balanced Ventilation Systems:

In a balanced ventilation system, there is both mechanical exhaust and supply systems designed to provide equal amounts of supply and exhaust air. A properly designed balanced system should maintain air pressure equal to the exterior. There is generally a single air intake in a balanced system. The supply air may be delivered to a single centrally located area or dispersed through ducting. The exhaust air may be derived from either a single intake or taken from high producing contaminant areas. The use of HRV's/ERV's is common in a balanced system.

Balanced systems are more expensive to install but can be less expensive to operate when energy savings are calculated. Due to the inherent energy saving characteristics of HRV's/ERV's, balanced systems become more and more attractive in extreme climate areas where conditioning costs are higher.

Alternative Designs:

The ASHRE standard allows for alternative designs. The use of a combination of continuous and intermittent mechanical ventilation is possible. There a no accepted prescriptive designs in the ASHRE standard for alternative ventilation systems. Generally, these systems would require blower-door or other testing to verify the proper function of design. In California, Energy code requires significant calculations that take into account many variables when designing systems.

If you haven't seen them yet – it is likely that you will in the near future. Inspecting these components may be outside the scope of what you may perform in a general property inspection. However, CREIA Standards indicate that "exhaust systems" and "conditioned air distribution systems" should be inspected. If you make a business decision to not inspect them, appropriate disclaimer language appears warranted. If you choose to include them as part of your inspection, it would be prudent to include appropriate limitations in the report as well.

About the author:

Skip Walker lives in the SF Bay Area and has performed approximately 2,700 paid inspections since becoming a CREIA member in 2003. Skip is both a CREIA Master Inspector and an ASHI Certified Inspector. Skip is an ICC Certified Residential Combination Building Inspector and a F.I.R.E. Certified Inspector. Skip is the CREIA Region Three Director, CREIA STATE Secretary and past Education Chair and ASHI President ay the Silicon Valley ASHI/CREIA Chapter. He also holds a California Real Estate Appraisal Trainee License. Skip may be reached at HomeInspection@sanbrunocable.com.