CertainTeed
SAINT-GOBAIN

Safeguarding the Health of Building Occupants

Adequate Ventilation and Moisture Management Greatly Improve Indoor Air Quality

Throughout the 1970s, the massive energy conservation movement impacted building design by inspiring the construction of airtight structures, sealed off from outside air that would improve overall energy efficiency. An unfortunate side effect of this otherwise good idea was that various airborne toxins, moisture and resulting mold originating inside the building were now sealed inside, creating poor Indoor Air Quality (IAQ). Now, building and design professionals are working hard to correct the design mistakes made some 30 years ago.

Improving IAQ in schools, health care facilities and commercial buildings has become a high priority of the sustainable building movement.

Workplace IAQ concerns were brought to the forefront in 1994, when the Occupational Safety and Health Administration (OSHA) issued its first proposal for regulating IAQ. This led to the creation of a detailed inspection and compliance program of building maintenance, ventilation, relative humidity (RH), and carbon dioxide control for certain non-industrial work environments. Since then, improving IAQ in schools, health care facilities and commercial buildings has become a high priority of the sustainable building movement, and rightly so. Poor IAQ, at a minimum, can cause headaches, nausea, respiratory irritation, coughing and difficulty with concentration among building occupants. When IAQ is at its worst, however, some building occupants may develop severe respiratory diseases, such as Legionnaire's Disease and asthma.

Picking up where OSHA left off, the American Society of Heating, Refrigeration, and Air-conditioning Engineers (ASHRAE) published its Standard 62.1, Ventilation for Acceptable Indoor Air Quality, to provide guidelines for improving IAQ through better ventilation. The first version — written in mandatory, code enforceable language that clarified compliance and enforcement issues — was published in 1994. The standard's goal is for buildings to achieve "acceptable indoor air quality," defined as "air in which there are no known contaminants at harmful concentrations as determined by cognizant authorities and with which a substantial majority (80 percent or more) of the people exposed do not express dissatisfaction." ASHRAE 62.1 is an excellent source for IAQ improvement information.

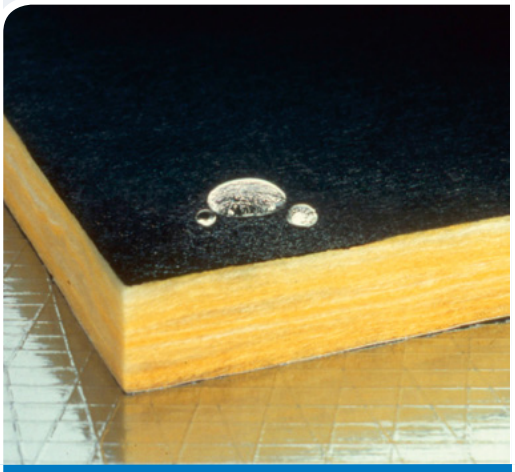
Today, the best measure we can take is to be proactive and use building science principles to prevent or correct problems with IAQ in buildings. In this article, we will discuss how adequate ventilation and moisture management techniques can greatly improve IAQ inside buildings. First, though, let's take a look at some of the sources of poor IAQ.

WHERE POOR IAQ BEGINS

IAQ can be threatened by a variety of things within a building, such as moisture, mold spores and dust mites, volatile organic compounds (VOC) and poorly designed air distribution systems.

FEATURED PRODUCTS

CertainTeed fiber glass insulation and MemBrain™



ToughGard® duct board

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Left: Moisture damage
Right: Mold growth

Moisture and Mold

Moisture, or humidity, presents a big problem in buildings that are airtight without proper ventilation. Excessive humidity can permeate a building, causing discomfort to building occupants and can get trapped inside wall cavities, saturating insulation and building materials. Wet insulation loses R-Value, making the building less energy efficient and can be a foster to mold growth. Mold can form on many surfaces within wall, floor and ceiling assemblies, eventually creating breathable airborne particles that are very unhealthy for building occupants.

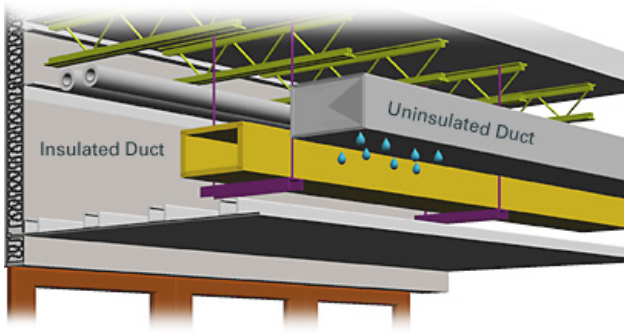
Harmful VOCs

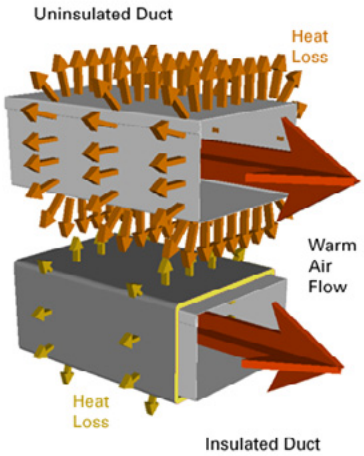
VOCs are carbon-based organic compounds and often come from solvents, cleaners and the exhaust given off by mechanical and electrical equipment, as well as building materials and furnishings. In most airtight buildings, there is not adequate ventilation to allow appliances to exhaust freely, causing them to backdraft harmful combustion products, such as carbon monoxide, into the building's interior. This stresses the importance of a good heating, ventilation and air-conditioning (HVAC) system to rid the building of these pollutants.

Poorly Designed HVAC Systems

A poorly designed HVAC system can create several problems. Inefficient equipment and leaky ducts can lead to more energy use and higher utility costs, not to mention discomfort for building occupants and other ventilation problems. Without insulation and periodical maintenance, ducts can also develop into a serious threat to IAQ, stemming from their natural tendency to produce moisture during air transmission. In the summer, condensation often forms on uninsulated ducts when cool air passes through warm ductwork. (The same is true in winter, when warm air passes through cold ducts.) Although this is a natural occurrence, it can create a breeding ground for harmful mold if dust or dirt is present and mixes with condensation. This is a major concern, as the ductwork is the vessel for conditioned air to be distributed throughout the building.

Properly insulated ductwork and a periodical duct cleaning schedule provide an excellent defense against poor IAQ.





Left: Condensation often forms on uninsulated ducts.
Right: Uninsulated ducts can lead to higher energy use and utility costs.

Properly insulated ductwork and a periodical duct cleaning schedule provide an excellent defense against this substantial contributor to poor IAQ and respiratory ailments in buildings.

SOLUTIONS FOR POOR IAQ

Fortunately, there are plenty of ways to minimize the sources of poor IAQ. Much can be achieved with good moisture management and HVAC duct design.

Moisture Management

It is extremely important to make sure the wall cavities and other unoccupied spaces of the building are properly equipped with quality insulation assemblies that include a breathable vapor retarder. This will not only increase the thermal performance of the building, but also minimize excess moisture. With the help of a vapor retarder facing, such as CertainTeed MemBrain™, fiber glass insulation is a powerful weapon against moisture and the damage it causes in homes and buildings.

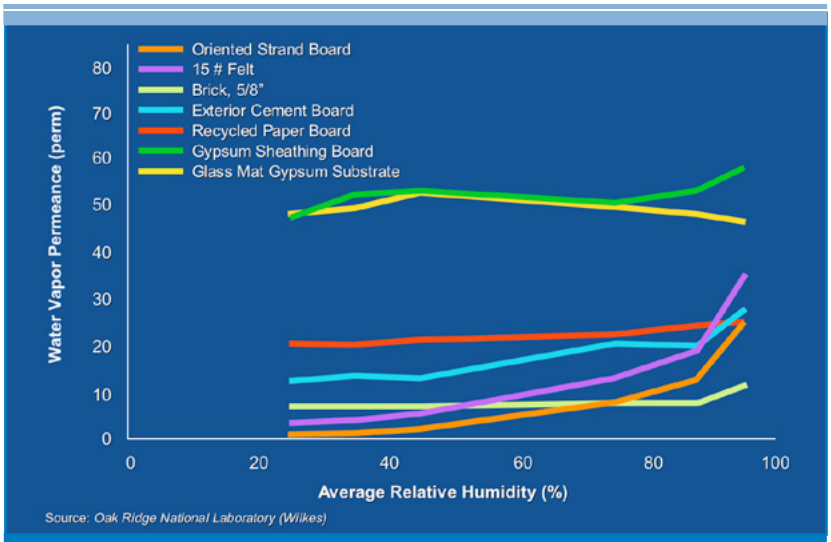
A standard vapor retarder's job is to resist the movement of water vapor to cold surfaces. A breathable vapor retarder, though, will change its permeability with the fluctuation of humidity levels from season to season. This "smart" facing helps reduce cavity condensation during winter and promotes drying to the inside during more humid seasons. Smart vapor retarders are available either separately or pre-attached to fiber glass batt and roll insulation, as with CertainTeed DryRight™ fiber glass insulation.

It is also recommended to seal off all penetrations in the building and install effective air barriers.

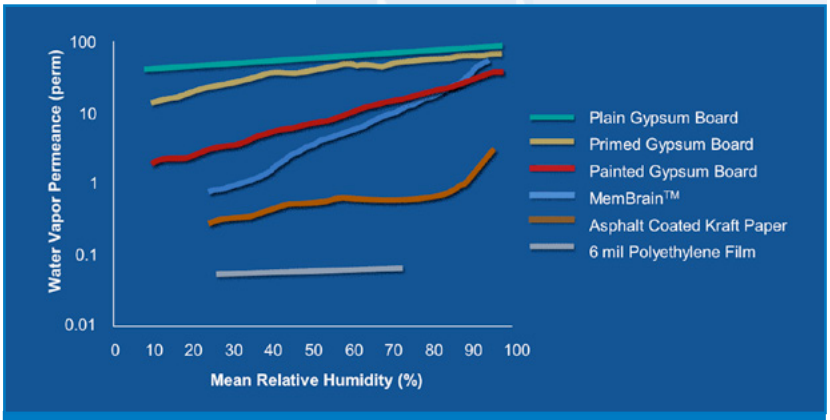
VENTILATE IT RIGHT

As stated earlier, an efficient HVAC system is vital for good IAQ. First off, choose energy-efficient HVAC equipment. Seal ductwork with appropriate mastic adhesive or tape to prevent leakage and locate ductwork in a conditioned or semi-conditioned space, wherever possible. This will minimize leakage to and from the outside environment, and prevent pressure imbalances. This can also be achieved by using ducted returns instead of wall or floor chases.

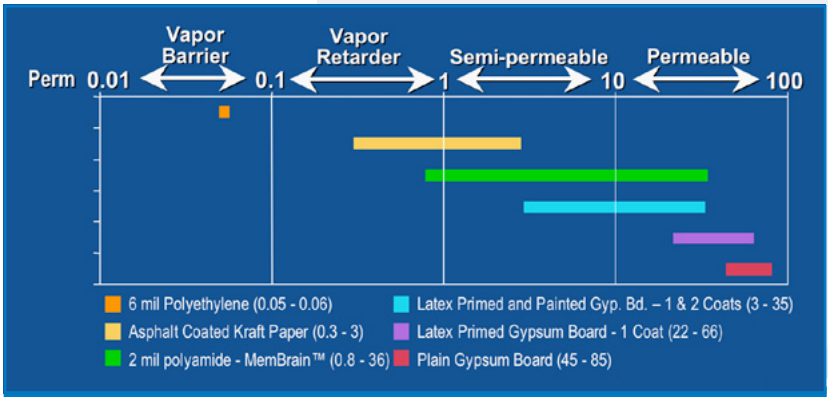
Also, design HVAC systems for proper exhaust ventilation and moisture removal, so that more moisture and pollutants are removed from the air. Of course, a more humid climate will require a system that will adequately handle more moisture.



Water vapor permeance of common exterior building materials.



Water vapor permeance of common interior building materials.

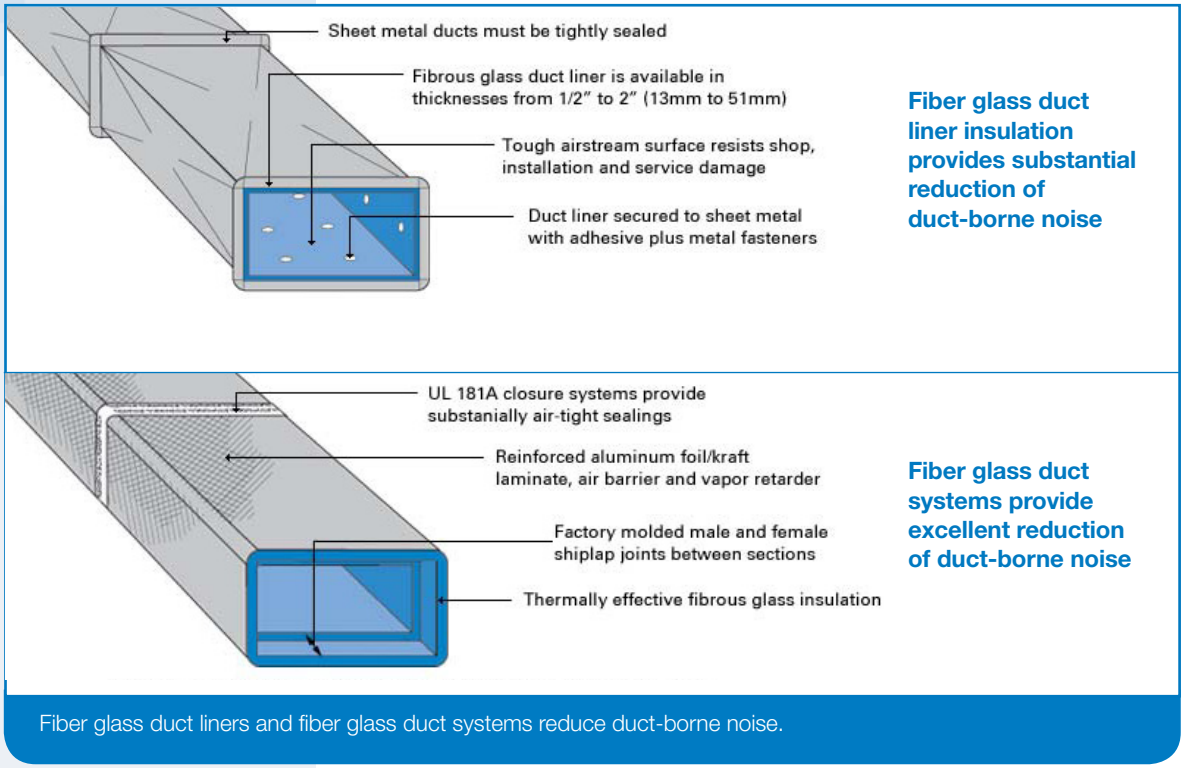


The above chart shows where the most common vapor retarder materials stand in the most current vapor retarder permeance rating system established by the 2007 supplement to the 2006 International Residential Code.

Another must for optimum leak-free performance and moisture management: Opt for either sheet metal ducts insulated with quality fiber glass liner and duct wrap or ducts fabricated from fiber glass duct board, all with enhanced surfaces, whenever possible. For example, CertainTeed ToughGard® fiber glass duct insulation products are GREENGUARD® certified for very low indoor pollutant emissions, which helps create superior indoor air quality performance.

According to the North American Insulation Manufacturers Association's (NAIMA's) *Insulation Facts 34: The Facts About Mold Growth*, fiber glass insulation is "inorganic and inert and does not support mold growth or act as nutrients for mold growth." Fiber glass duct liners are also resistant to microbial attack, as described in ASTM International C 1338, *Standard Test Method for Determining Fungi Resistance of Insulation Materials and Facings*, and as required by ASHRAE 62.1, Ventilation for Acceptable Indoor Air Quality, for HVAC air stream surfaces.

Once installed, the best way to ensure ducts stay mold-free and perform efficiently is through a regular maintenance schedule. This is vital, regardless of whether the ductwork is internally insulated or uses bare sheet metal. Since preventative maintenance is very important in HVAC system operation, many architects and engineers have begun to add this recommendation to their specifications.



Fiber glass duct liners and fiber glass duct systems reduce duct-borne noise.

CONCLUSION

Following these guidelines should provide a solid start toward fostering good IAQ in your facility. The important thing to realize is designing a building that's merely airtight is not the answer to sustainability. The answer is designing a properly insulated building with adequate ventilation, an environment, which if well maintained, will provide a high level of IAQ. Good IAQ means a healthy building with healthier, happier, more productive occupants.

MemBrain™ is a smart vapor retarder that changes its permeability to water vapor as ambient humidity changes.

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