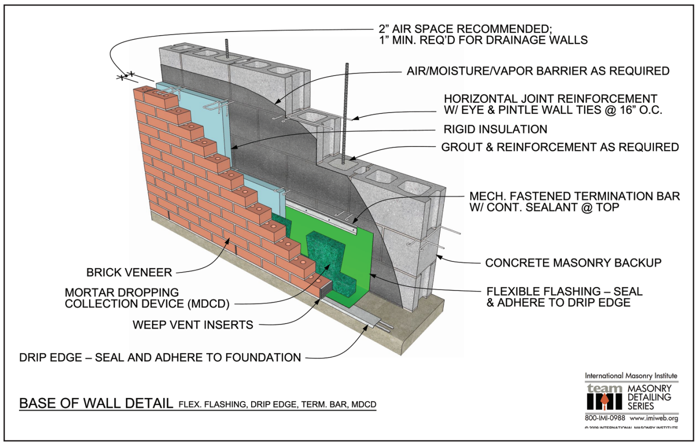
Section 2.1.2

AIR BARRIER SYSTEMS

Since 2001, many states have adopted air barrier language into either their local energy code or building code and there are other states with pending proposals. In addition, Chapter 14 of the International Building Code (IBC) refers to mandatory air leakage control requirements in the International Energy Conservation Code (IECC).

Early in the air control movement, the primary goal of air barriers was to control condensation within exterior wall and roof assemblies. While moisture-related problems are more easily observed and documented, the positive impact of building air tightness on energy consumption is becoming more evident. In 2005 the National Institute of Standards and Technology (NIST) documented the impact of air barriers on heating and cooling energy savings in different United States regions. For example, energy savings in northern climates were found to be as much as 40% during the heating season and 20% for cooling. The energy savings as a result of air barriers directly address the intent of LEED Energy and Atmosphere Credit EA 1, Optimize Energy Performance. One organization within the environmental and energy conservation movement advocates installation of air barriers as one of the top five "no-brainer" sustainability strategies available to designers.

The purpose of air barrier systems and how they differ from vapor control and moisture control layers can be a source of confusion in the design and construction community. Air barriers stop air movement. Vapor barriers stop vapor diffusion. Moisture barriers—sometimes referred to as dampproofing or water-resistive barriers—stop liquid moisture. Each one of these systems has performance requirements specific to its intended primary function. Air barriers are measured by air leakage ratings while vapor barriers are measured vapor permeance ratings—the two rating systems are not interchangeable. In other words, "perm" ratings do not measure the ability of a material to stop air. However, to add to the confusion, one material can satisfy more than one of these functions. For example, an air barrier product has the potential to keep water from passing through it (moisture barrier), stop vapor diffusion (vapor barrier), and stop air leakage (air barrier). It all depends on the physical properties of the material.



Detail from www.imiweb.org/masonry details.

The physics of moisture movement demonstrates when air moves it takes moisture with it (air leakage), but moisture can move without the movement of air (vapor diffusion) -via pressure differential. The transport of moisture via air is many orders-of-magnitudes larger than that with vapor diffusion. Thus, to achieve energy conservation and control moisture migration, it is much more important to install an air barrier system rather than a vapor barrier—most vapor barriers are not sealed, durable nor continuous. Originally most air barrier systems were designed to stop both air leakage and vapor diffusion but new air barrier products in the market come with options to be vapor-open (permeable) or vapor-closed (non-permeable). Vapor-open air barrier products are sometimes used in wall assemblies made of non-masonry moisture sensitive materials, when designers want building envelopes to have increased drying potential, or when it is not resolved where the dew point occurs within the wall.

Air barrier systems are designed to stop moisture-laden air from moving through, under and over wall or roof assemblies. The intent of air barrier systems is to stop air from both infiltrating and exfiltrating buildings. Because of natural stack pressure or HVAC induced positive building pressure the typical flow of air through exterior building envelopes is exfiltration. Because air barriers are often subjected to pressure from both directions, they need to be durable and firmly attached or adhered. The main goal of air barriers in northern climates is to stop air from exfiltrating through the exterior building envelope during the winter when wall components inside the wall are cold enough to transform airborne moisture into liquid moisture. The application and location of air barrier systems for masonry cavity walls (masonry veneer with a masonry back-up wall) are straight-forward and economical—simply use one material to control moisture, air and vapor and keep it on the warm- in-winter side of the thermal control layer. This works in any climate in the country.

For single-wythe masonry walls, air barriers still need to be installed on the interior side of the wall insulation. If the wall insulation is inside the wall, then an economical air barrier solution is an air-tight paint assembly on the inside wall surface, applied all the way to the top of the wall with transition material making the connection from the wall to the roof deck or spandrel beam above.

Air barrier installation in anchored and adhered masonry veneer walls (masonry veneer with a metal or wood stud back-up, with or with out an air space) can be challenging and a dew point/condensation analysis is recommended. As the design community becomes more savvy in terms of energy consumption and condensation control more designs will utilize a continuous thermal control layer located on the exterior of the building structural wall to eliminate thermal bridges and locate air barrier systems between the insulation and exterior sheathing for greater continuity and durability. Air barriers located on the interior side of stud walls are more prone to penetrations, often discontinuous in the ceiling plenum and not connected to the roof deck or floor above. Poor top of wall details are commonly the cause of significant air leakage. Depending on geographical influence and building occupancy, hybrid insulation strategies can be used by locating enough insulation on the exterior of the air barrier to keep it warm during the winter while supplemental vapor-open insulation is used between the studs.

There are many types of air barrier systems currently available. To date, the most common and best performing air barrier systems are fluid-applied elastomeric coatings and fully adhered membranes. Spray-applied urethane foams that provide both an air and thermal control are being introduced. Like fluid-applied air barriers, the wall to receive a foam air barrier must be prepared with transition materials before the foam is applied.

Fluid-applied elastomeric air barrier (yellow material) with transition material on CMU wall—installed by masons.

The key to a properly installed air barrier system is coverage of the whole exterior building envelope and connection to interfacing wall building components such as doors, windows, structural components, back-up wall material changes, movement joints, roof and floor interfaces, utility penetrations, and other gaps. For instance, it is not good enough to cover 99% of the wall with an air barrier product and leave open the gap between the top of wall and bottom of the spandrel beam. All holes must be plugged with durable material compatible with other air barrier products in the system. In addition, air barriers need to be physically connected to the roof air control layer. This often happens atop the parapet wall.

Air barriers should be installed by trained air barrier installers. Above-grade air barrier installations are different than below-grade dampproofing because above-grade walls are not monolithic like foundation walls. Masonry craftworkers are being trained to install air barriers through organizations like the International Masonry Institute, Air Barrier Association of America or product manufacturers. If masonry is involved either as a veneer, back-up wall, or both, it is a good idea to have the mason contractor responsible for the air barrier installation so the client has a single-source of responsibility for the overall performance of the exterior wall. This will also help with scheduling and sequencing of work such as flashing coordination, installation of veneer anchors, material storage, delivery and scaffold use. It makes sense for masonry contractors to install air barrier systems because they interface with it more than any other trade and are already familiar with installing insulation and moisture control layers.