Improving Performance of CMU Backup Walls

Air & Water-resistive barriers protect against energy loss, condensation & water intrusion

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An insulated masonry cavity wall’s energy effectiveness improves with the simple addition of a continuous air barrier – according to National Institute of Science & Technology (NIST) study, an average of 40% in natural gas, 25% in electricity.

From reading Dan Zechmeister’s article “Loadbearing Masonry’s Bottom Line” in The StoryPole’s 2008 Resource Guide, you know better than to build with sheathing walls because, if they are not properly detailed, they could leak.

Also, as Zechmeister points out, block walls handle condensation better. If block walls leak air carrying water vapor, they benefit from air barriers being added to the cavity wall system. Even the water-holding capabilities of block can be overwhelmed.

That’s why Pat Conway, one of the lead masonry troubleshooters for the International Masonry Institute, has written numerous articles on avoiding condensation in masonry walls by using air barriers.

Saving Resources

And it’s not just water vapor traveling with that air leakage. Conway also points out there are energy dollars moving with it, too. A computer simulation on a hypothetical brick-over-block school building in Wisconsin showed that adding an air barrier to the design decreased natural gas consumption by 58% and electricity consumption by 22%.

This matches the recent study Investigation of the Impact of Commercial Building Envelope Airtightness on HVAC Energy by the National Institute of Science and Technology (NIST). That study looked at 116 existing buildings and did extensive computer modeling on various wall assemblies including block backup walls in masonry cavity wall construction.

NIST found that on average air barriers will save greater than 40% in natural gas and greater than 25% in electricity.

Jane Snowdon, a key executive at IBM’s Intelligent Building and Smarter City program, told an audience at the Healthy Buildings 2009 conference that “buildings need to be smarter because they consume 70% of the world’s electricity...”

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What is an Air Barrier?

The Air Barrier Association of America explains an air barrier system. “The air permeance of any air barrier material is 0.02L(m²•s) @ 75Pa. The air permeance of drywall is equal to this and is used as a control material. So any material that has an air permeance equal to or less than this value qualifies as an air barrier material. In any building, there are hundreds of materials that meet this requirement.

“Having air barrier materials in a building does not provide you with a continuous plane of air tightness. To achieve this you must join the various air barrier materials together using air barrier components. These components connect one material to another material, a material to an assembly, and one assembly to another assembly. The air permeance of an air barrier component is 0.02L(m²•s) @ 75 Pa.

“An air barrier assembly is simply a collection of air barrier materials assembled together using air barrier components to provide a continuous plane of air tightness for that assembly (i.e. wall assembly). The maximum air leakage of an air barrier assembly should be 0.2 L(m²•s) @ 75 Pa.

This is hard to explain, given that the conditions for internal condensation are worst-case in the North due to cold external temperatures. A vapor-permeable air barrier will allow internal water vapor to escape outwards in cooler months and avoid internal condensation.

The stronger argument for an external vapor barrier is in the Deep South where intense external heat and humidity create a strong inward vapor drive, and the conditions for winter condensation (discussed above) and winter drying (discussed below) are less favorable. However, testing, modeling and experience have shown that vapor permeable air barriers perform well both in northern and southern climates.

Some have put forth external insulation to keep the external vapor barrier warm in the cold months to avoid internal condensation. But contractors say “It’ll end up layin’ loose in the cavity like it always does.”

And no insulation can solve the small thermal bridging of brick ties that chills the vapor barrier underneath the insulation.

Then there is the drying problem with vapor barriers. Walls can dry in two
directions – toward the inside and toward the outside. You want to preserve drying capability in both directions. In the cooler months of rain and snow, indoor/outdoor temperature and humidity differences favor drying to the outside. You can’t do that if a vapor barrier is out there.

“Air leakage can carry several hundred times more water vapor than vapor movement.” (Brick Industry Association Tech Note 21) This is why use of a vapor permeable air barrier to cut off the bulk exodus of water vapor with air leakage in cold months eliminates interior water vapor as a source of condensation in masonry cladding.

So, why anyone would specify a vapor barrier air barrier remains unclear. Some say that a northern building code requirement to place a vapor barrier on the “warm-in-winter side of the insulation” created a requirement for the external air barrier to be a vapor barrier. This ignores the history of that provision which was put in place to prevent water vapor inside the building from finding its way to the backside of the backup wall.

Clearly, an external air barrier vapor barrier does not do that. Also, the provision never applied to block walls. It was always limited to stud walls.

Fortunately, the source of the confusion has been eliminated because the phrase no longer appears in the commercial International Building Code (IBC) nor in the International Energy Conservation Code. Instead, now the IBC 2006 says (for northern climates): “Vapor retarders shall be provided on the interior side of frame walls.”

So, there is no technical or regulatory requirement that an external air barrier be a vapor barrier.

Benefits of Acrylic Aggregate Emulsions

While there are several types of products that act as air barriers, more than 53 million square feet of backup wall have been treated with acrylic aggregate emulsion water-based coatings registered with the Air Barrier Association of America (ABAA). They have passed the air leakage tests when applied to block walls based on ASTM E2178 as modified for concrete masonry unit (CMU) testing by the ABAA.

These coatings have also been approved by the International Code Council Evaluation Service to meet the code requirement for water-resistant barriers on sheathing. Although this is a sheathing requirement, it is an important stamp of approval and proof that a coating need not be as thick as roofing material to be effective on a backup wall. These systems render block water-resistive. They apply with typical paint equipment at typical paint thicknesses.

Every day thousands of people jump out of airplanes in reliance on parachute fabric 3 mils thick. A material does not have to be thick to be effective.

Acrylic-based systems are part of the family of coatings technologies recently awarded historic landmark status by the American Chemical Society for durability and environmental safety.

Acrylic aggregate emulsions have such low solvent content that they pass the most stringent Southern California solvent restrictions.

Demonstration applications can be done on mock-up walls inside distributor and contractor offices because participants do not even notice any odor or fumes. The UV window is six months. This means application contractors can mobilize one time per project – with all the time and money savings that can mean.

Application

Use conventional airless paint sprayers and or rollers and brushes as desired. Mason contractors are expanding their contract scope and taking advantage of their in-place scaffolding by taking the half-day training to apply these systems. (One contractor reports making more money applying the coating than in erecting the block backup wall.)

Two spray coats on CMU at a typical coverage rate correspond to 15 wet mils per coat.