The Case of the Peeling Air Barrier

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Photos courtesy of Gale Associates, Inc

In the United States, air barriers have become an integral part of modern construction since the start of the 21st century. Since 2001, several states have implemented the requirement of a continuous air barrier within their building codes.

With the introduction of a continuous air barrier in ASHRAE 90.1-2010 Energy Standard for Buildings Except Low-Rise Residential Buildings and the 2012 International Energy Conservation Code, the adoption of air barriers is expanding. The driving forces behind this movement are to decrease energy costs, address the health and well-being of the building’s occupants, and increase facility durability through control of air infiltration and exfiltration within the exterior building enclosure.

Unfortunately, the applications don’t always match the intentions...

Air Barrier Background
There are three primary types of air barriers: fluid-applied (FA), self-adhered (SA), and spray polyurethane foam (SPF). Each of these has its own unique characteristics and properties. However, they all have the following basic principles in common:

- Continuous
- Able to withstand positive and negative wind, fan, and stack pressures enacted on a building
- Capable of transferring the load to the structure
- Durable and maintainable
- Able to accommodate movement in the structure
- Meet air permeability requirements of 0.004 CFM (0.0001 cm/min.) per square foot (0.09 m²) under pressure differential of 0.3 inches (7.6 mm) of water

Air barriers do not just stop uncontrolled air infiltration. Since air contains moisture, air barriers also help to avoid the deterioration and mold caused by moisture condensing within a wall assembly.

Unfortunately, many installed air barriers fail after a short period of time.
FA air barriers require substrates that are structurally supported, smooth and continuous, dry, clean and free of debris, and uninterrupted at transitions.

The county courthouse building was to receive rigid insulation over the FA membrane. The roof assembly had not been installed prior to the FA air barrier installation.
synthetic rubber FA materials can be applied at colder temperatures, some down to 20° F (-6.7° C), when compared to some water-borne materials that cannot be installed when ambient temperatures fall below 40° F (4.4° C).

Lastly, it is important to consider if the material is compatible with incidental materials, such as sealants and primers. Should a solvent-borne FA air barrier be applied where it will come in contact with a transition membrane using a water-borne primer? Can it be installed over silicone sealants? These are a few of the items to ponder prior to material selection.

Courthouse Coating
Over the years, we have encountered a number of FA air barrier failures. Fortunately, many of those were observed prior to the installation of outboard insulation and wall cladding — when there was still a chance to repair the issues. Failures occur due to several reasons, but they mainly come down to poor workmanship, improper training, and poor site coordination. A well-installed FA air barrier is heavily reliant on the installer’s knowledge. Several manufacturers require that purchasers of their products be capable of installation, and they insist on training and certification for installers and contractors.

In addition to the installer, the general contractor and designer must be familiar with the limitations of the material and requirements for an air barrier assembly. Failures have occurred due to a lack of coordination between sub-contractors as well as sequencing by the general contractor. For instance, should the roof be installed before the air barrier is installed? Does the roof vapor barrier counter flash or overlap the wall’s air barrier?

In the case of a building in North Carolina, signs of a premature coating failure were observed. The building was a new split-level county courthouse consisting of steel-frame concrete masonry unit (CMU) and gypsum wall sheathing (GWS) backup walls with brick masonry unit (BMU) veneer, rigid insulation installed over an FA air barrier applied to the substrates. The roof assembly was not installed prior to the air barrier installation. It would consist of a single-ply roof membrane over an insulated metal deck.

The air barrier assembly required the installation of an SA transition membrane at changes in substrate plane (i.e., inside and outside corners) and transitions between different substrate types (i.e., GWS, CMU, steel, and concrete). Transition membrane installation was also required over steel relieving angles and around window openings and wall penetrations. The SA membrane required the application of a primer to the substrates prior to installing the transition membrane over the CMU, GWS, and steel substrates. According to the installer, the installation was progressing well, until the FA air barrier contacted the substrate primer.

Based on the site visits conducted by the air barrier auditor, installation...
Peeling Air Barrier

The installation of air barriers, especially FA air barriers, are dependent on proper sequencing of construction as well as protection. Without a roof in place, the air barrier is subject to damages from moisture infiltration. One way to prevent these failures is for the general contractors to hold pre-construction meetings with their subcontractors, manufacturers, designers, and the exterior building enclosure consultant.

Material selection and the submittal review process also have large roles in the final outcome of air barrier installation. The products need to be reviewed and tested for potential compatibility issues with other materials with which they will come in contact.

Additionally, it is important that installers and contractors monitor weather conditions before applying FA air barriers. On many occasions, we have encountered installations that “washed-out” because of rain. While projects are schedule-driven and general contractors are under pressure to turn the project over to the facility owner, installing air barriers during or prior to less-than-favorable environmental conditions, prove costly in terms of unexpected problems and construction delays because the work needs to be done more than once.

Installer and contractor training, as well as workmanship, play the largest role in the final outcome of an air-barrier installation project. A well-trained, knowledgeable contractor will know when an air barrier can or cannot be installed and over what material an air barrier can or cannot be installed.

Team Work

In general, working with FA air barriers can be beneficial for various reasons. Without a proper design, plan, and installation, though, these coatings can be rendered useless. If the team can work together, the coating can do its job. CP

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Self-adhered (SA) membranes were required at transition points, and a primer was required for the SA membranes. It was found that the primer was not compatible with the FA barrier.