Today’s masonry structures require a higher level of performance. Building envelopes must be designed to control the transfer of heat, air and moisture to control energy costs, occupant comfort and health. Temperature is controlled with thermal insulation and sealing to eliminate air leakage. Water leaks must be prevented and moisture vapor diffusion controlled to prevent mold and mildew, optimizing healthy indoor air quality.

While masonry can be shaped and sized to provide any geometric shape retaining strength and durability, it needs a clear drainage cavity to act as an effective barrier to heat and moisture transmission. Joints can lead to air leakage. To capitalize on the best properties of masonry designs and overcome inherent weaknesses, designers and builders recognize spray foam insulation as a solution to heat, air and moisture control.

Expands in Place
Closed cell spray polyurethane foams (ccSPF) were developed in the 1950s and quickly became the insulation of choice for extreme temperature vehicles, buildings and tanks. Freezers, refrigerated trucks, wood kilns, controlled atmosphere storage and temperature controlled tanks were many of the early applications. Spray polyurethane foam (SPF) fully adheres to common building materials. Since SPF is spray-applied as a liquid which expands in place, the shape of the area to be insulated does not matter: odd-shaped gaps and joints can all be filled, covered, air sealed and insulated.

When a building is continually conditioned to a higher or lower temperature than the exterior air temperature, condensation control is always of major concern. For modestly insulated buildings of the 1960s, ’70s and ’80s, this was not typically considered. As energy cost and usage became a greater concern, thermal, air and moisture controls became more important to the building science world.

R-"/
A nominal density of 2.0 pounds per cubic foot provides optimal R-value per inch of thickness (R-value varies by manufacturer and product, but most exceed R-6 per inch) while providing the moisture and structural physical properties that make it a multi-functional product. The applied product has a compressive strength greater than 25 psi or 3600 psf, strong enough to support a concrete slab floor and the load that will be applied to that floor. It can also support below grade exterior applications with soil backfilled against the foam.

A continuous layer of SPF forms a membrane which, by its closed cell structure, will not permit water penetration under hydrostatic pressure. It can water-seal a masonry building assembly and is certified as an exterior water-resistive barrier.

Just as water will not penetrate SPF, air is also blocked by the physical performance of the foam membrane. SPF can air seal construction gaps, plumbing and electrical penetrations as well as joints of dissimilar materials such as roof deck/wall junctions. Its ability to air seal stops heat bypass of...
the insulation membrane and allows thermal performance of the R-value at maximum efficiency, thereby lowering energy requirements to control interior temperature.

Water Vapor
With water sealed out, air leaks eliminated and thermal boundary established, the next concern is water vapor diffusion. Movement of water, a liquid, is well understood. Water vapor, on the other hand, is a gas and its transport mechanisms are subtle and less understood. Its control is very important to ensure indoor air quality and building longevity. Where air and water may be blocked from passage by solid building planes and sealed joints, moisture vapor has the ability to diffuse through a solid material, thereby moving moisture from areas of high moisture content to areas of lower moisture content. In normal situations, warm air holds more moisture than cold air, so moisture vapor tends to be movement from hot to cold areas. Therefore, water vapor control must be managed in conjunction with the thermal boundary.

Generally speaking, buildings in warm climates have a vapor retarder installed on the exterior side of the insulation and buildings in cold climates have a vapor retarder installed on the interior side. Common in both situations is the vapor retarder on the warm or higher humidity side of the insulation. However, this is simplistic: It does not take into account buildings in mixed climates or buildings with both high cooling and high heating loads. Because the closed cell foam is both the thermal boundary and the moisture vapor retarder, the vapor retarder is never on the wrong side.

Application Guidelines
Scheduling and construction issues that should be considered with the SPF can normally be addressed in pre-bid and pre-construction meetings. Brick ties need to extend out from the base wall enough to permit the foam application without covering the eyelets. If foam is to be 2" thick, the eyelets should extend at least 2.5". All wall penetrations for electrical and plumbing should be roughed in and the roof deck installed prior to the foam. Spray foam can seal the openings and wall/roof junction to provide the air/water seal. Window details need to be planned. In some cases, jamb muscles can be bump outs that can be inserted prior to spraying.

Foam can be sprayed directly to the jambs with no additional flashing. In other cases, the product has to be installed with a space left for the window/door framing to be attached directly to the structural wall where the jamb to membrane seal will need to be finished later. Compatible thru-wall flashing can be laid into mortar between concrete block courses or can be a peel and stick membrane applied after block is laid. Either way, the compatible thru-wall flashing can be raised up by hand and the spray foam applied under it to insulate and seal the lower section of the wall. Then the foam can be applied to the wall above the flashing. This is best accomplished prior to any brick being installed.

Every construction job has unique aspects. It is just a matter of communication with the applicator to reach the best solution. For the masons and general contractors who have not worked with this method before, the key is to remember the purpose of the foam is to seal the wall as well as insulate it. Sometimes, bracing for scaffolding has to be attached to the base wall. If damage to the foam membrane cannot be avoided with prior planning, the applicator can make the necessary repairs to reseal any damaged areas.

Masonry building materials are the first choice for many designers and builders of commercial and institutional buildings. Masonry can be constructed to provide any required level of structural strength and provides the greatest fire resistance possible for walls and structural elements. As the exterior facing, masonry provides the durability other products cannot match, evidenced by the many historic castles, churches and cathedrals around the world. As an interior finish, masonry
Closed Cell Spray Foam

provides the most durable surface
to withstand the physical contact
that walls will endure from people and
moveable equipment.

Multiple functions of the unique foam
membrane and ease in dealing with
d geometric shapes and construction
junctions/ gaps ensures the issues of heat,
air and moisture are addressed resulting
in a superior energy efficient building. This
SPF is fully supported with third party
testing and has a nationwide network of
certified applicators.

With more than 40 years of experience
in applications on extreme temperature
masonry buildings, the recent growth
in applications to build higher energy
efficient standard buildings is a natural
progression. Designers can be totally
free for creative designs with shapes,
sizing, wall and roof junctions, arches
and window/ door openings and still
be able to insulate, air seal, water seal
and control moisture vapor drives
with SPF.

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