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Walls and Ceilings

Wall Expansion Joints Do More Than Fill a Gap

by Dennis Callahan
February 1, 2010

ARTICLE TOOLS

The modern expansion joint should stand the test of time in structural movements.

Today's wall systems are being designed and constructed to perform a growing number of functions. Beyond simply separating rooms or enclosing a structure, they are now expected to maintain thermal conditions, contain the spread of fire, suppress the transmission of sound, and seal out the intrusion of water and wind. But as with any system, performance is only as good as its weakest link.



Expansion joints historically represent the weakest link in wall assemblies. Mandated to accommodate anticipated structural movement, expansion joints are literally a gap or break through the entire system. The ideal expansion joint filler would be one that will not only handle the gap's expansion and contraction but also perform all other functions expected of the adjacent wall system.

WHY AN EXPANSION JOINT?



A building's mechanical rooms present many sealing challenges to any expansion joint seal including fire, heat, and sound. The installation seen above establishes and maintains a continuity of seal by joining the wall and floor gaps in one continuous system.

Building materials comprising of walls and ceilings move due to thermal expansion and contraction, structural shifts, and seismic activity. These forces mandate the need for purpose-designed gaps that permit the building materials to move independently of one another without damage. Smaller planned crack locations are considered control joints while other locations need to accommodate greater movement and therefore require larger gaps. These larger gaps need to be fitted with structural expansion joint fillers. It is important to fill these joints with a sealant or expansion joint system, which preserves the attributes of the wall.

These attributes may include a designated fire rating, sound attenuation, watertightness, wind resistance or a thermal rating. Many expansion joint systems on the market don't take into consideration the importance of these requirements and only function on an aesthetic level at best. The ideal solution would match the attributes of the expansion joint system to the requirements of the wall or, at the very least, ensure that the expansion joint material does not degrade any aspect of the wall assembly's performance.

Early in the design process, an assessment should be made of what is required of the expansion joint system. The proper system should be carefully engineered and selected to best match all of the wall's properties while handling the expected movement. The wrong choice in an expansion joint can allow fire, moisture, heat and cold, sound or other unwanted elements to pass through the wall at the location of the expansion joint gap. For example, metal-track-and-rubber-gland systems ("strip seal systems") that can fill the void and may handle the wall's movement will not effectively block the passage of sound or provide for watertightness, fire-spread prevention or thermal insulation. Or, as is often done, fiberglass insulation is stuffed behind an expansion joint cover to help meet the wall's thermal rating. When movement occurs and the wall cycles at the joint gap, the insulation (which has no memory) is crushed and can no longer function as intended.

PRECOMPRESSED FOAM SOLUTION

The better solution to maintain the integrity of an interior or exterior wall system is a preformed, precompressed foam expansion joint. This product is constructed of acrylic-impregnated foam which is factory coated with an exterior sealant specifically chosen to handle the wall's environmental, occupancy, and aesthetic requirements. These single-unit expansion joints are manufactured and readily available in today's market. The exciting developments within this product design are advancements in composition of the foam, impregnation and the sealant technology that are keeping pace with the evolving performance expectations of the adjoining walls.

SOUND ATTENUATION

Interior and exterior walls are expected to block out sound transmissions from between rooms or from the outdoors to the inside of a building. A good expansion joint should basically be able to maintain the sound suppression level of the wall. ASTM E413 (Classification for Rating Sound Insulation) and ASTM E90 (Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements) tests are used to determine the rating for interior noise transmission (Sound Transmission Class) and exterior noise transmission (Outdoor-Indoor Transmission Class). Superior wall sound attenuation (STC 50 or higher and OITC 40 or higher) should be approximated or met by the expansion joint installed in the joint gap. If the joint rating falls much below the wall rating, then the sound suppression of the entire wall is compromised. Current precompressed foam sealant technology has proven successful in meeting these sound attenuation requirements due to its unique cellular composition which has the ability to baffle and suppress sound. The STC and OITC performance of an expansion joint



A single-unit, multi-purpose expansion joint fills the entire gap and provides all of the features of the adjoining walls. Note that there is no need for a coverplate system.



should always be determined and matched to the wall as a principle criterion of selection.

FIRE RATING AND LIFE SAFETY

Building codes and concerns for life safety mandate that walls be fire-rated in order to contain the spread of fire. Without a fire-rated wall system, fire can travel between building compartments (floors and rooms) or through an outside wall where it can wrap back into a building a floor above. A joint gap, like an open door, is an ideal passage for flame and smoke. Any product being considered for specification in expansion joints should be UL 2079 tested and certified before it is accepted for use in life safety situations.

Preformed, precompressed expansion joints are now available with a fire-retardant impregnated foam and intumescent coating, as well as with an additional watertight weathering surface. When such materials have successfully endured the normal and seismic joint cycling, fire testing, and hose stream components of UL 2079 testing, they are certified for up to a 2-hour fire rating.

The obvious benefit is having a single product with the ability to work as a fire block while still performing all of the other functions normally expected of the entire wall assembly including the expansion joint.



An expansion joint set in place that maintains the performance properties of the interior wall system. The watertight silicone outer seal of the precompressed, impregnated foam joint is manufactured to color coordinate with the tile and stone façade of the wall.

THE ELEMENTS

Expansion joints should do more than handle structural movement. They also act as a seal to maintain the environmental conditions on both sides of the wall. Wind and water are often the downfall of expansion joints. There are several ways that the uncontrolled passage of air and/or water through wall assemblies can dramatically impact a building's performance. Managing the comfort of the interior environment of a building hinges on the compartmentalization of HVAC air movement.

Energy efficiency can be substantially enhanced by controlling the infiltration and exfiltration of air through exterior walls as prescribed in air-barrier assembly design. Additionally, all structures are subjected at some time or another to high winds and wind-driven water from micro-bursts, tornados, or hurricanes. ASTM prescribes several tests designed to prove the ability of a wall assembly to withstand the effects of air, wind and water from these various sources.

Ironically, these tests can be passed without the presence of an expansion joint within the wall assembly. Furthermore, seldom are these standards required in specifications of expansion joint sealants alone. It is good practice to select materials that meet these standards and to require in the submittal package

independent laboratory certification of testing and passage of ASTM E-330 (Structural Performance of Curtain Walls by Uniform Static Air Pressure Difference—Gust Loads), E-331 (Water Penetration of Curtain Walls by Uniform Static Air Pressure Difference), and E-283 (Rate of Air Leakage Through Curtain Walls).

Commonly specified expansion joint fillers like strip seals, extruded-rubber compression seals, and cover plates cannot by design pass these tests. Gaps in joints of the aluminum rails and plates, non-airtight interfaces between product components, as well as the undulations of typical substrates prevent these technologies from sealing adequately under wind and wind-driven water conditions. A lack of resilience in the rubber glands of strip seals prevents this technology from resisting pressure loads.

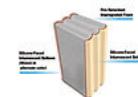
Precompressed, preformed foam sealants with a factory-coated facing provide a primary seal capable of far exceeding the pass criteria of these ASTM tests. They possess the ability to move with structural or thermal shifts while maintaining a wind and watertight seal. The latest evolution of this time-tested technology is comprised of cellular polyurethane foam that is infused, or impregnated, with an acrylic-based polymer that is free of older wax or asphalt compounds. These compounds can compromise movement and cause compression set. In the summer, when thermal expansion of walls causes expansion joints to close down in size, high heat conditions and compression occur that can result in these compounds bleeding onto or into substrates. Requiring independent lab certification through FTIR analysis can ensure that the materials being submitted are free of wax or asphalt compounds.

Independent laboratory certification to ASTM E-330, E-331 and E-283 will provide assurance that the products being submitted have displayed no water leakage at pressures equal to winds above hurricane force and wind loading that shows essentially no deflection at positive or negative pressures of up to 4950 Pascals (equal to 200 mph wind loads). It is not unreasonable to expect an expansion joint sealant to perform to these standards as the technology exists to do so. It is reasonable to demand certification through independent testing that the product being used has been proven to perform at the level expected of the wall assembly.

NON-INVASIVE INSTALLATION

When an expansion joint or joint system is installed, it has to be held in place in the expansion gap. Traditionally, mechanical or plated systems were anchored in place through intrusion of the substrate by screws or drilling which both damaged the wall and often compromised the seal. Precompressed, impregnated expansion joints offer a simpler solution -- they are held in place by the backpressure of the foam's compression and the pressure-sensitive adhesive nature of the impregnation. This non-invasive anchoring eliminates any damage to the joint surfaces or the adjacent walls. This method also permits the joints to be installed in corners and at turns that are impossible to seal with screw-anchored strip-seals. It is also the easiest and most logical solution for retrofit applications where failed joints need to be removed and replaced. Of added importance is the quicker and cleaner installation that a foam product provides—this dramatically reduces installation time and is ultimately more cost-effective.

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SUMMARY

Choosing the right expansion joint in today's design and building environment has evolved from demanding a traditional single-purpose product to a multi-purpose product.

Today's expansion joint seals are expected to eliminate the passage of air through wall assemblies, thereby minimizing energy use and loss and maintaining HVAC balance, while sealing interior space from exterior temperature conditions, wind and moisture. This

seal should remain in place throughout a full range of environmental conditions such as driving rain, hurricane-force winds, and extreme hot and cold thermal conditions. Because sound attenuation is a key purpose of a wall system, the correct expansion joint should meet or exceed the sound transmission classes (STC and OITC) of the adjoining walls. There can be no compromise on the life-safety issue of compartmentalization to ensure fire containment and minimization of fire and smoke spread. Expansion joints are manufactured to stop the spread of fire and should be UL 2079 certified to prove their ability to do so while also being able to accommodate joint movement.

The good news is that in precompressed sealants, expansion joint technology has evolved to keep pace with advances in building science and design. It is possible today to get all of these performance criteria in the single installation of a single technology and structures around the world are now benefiting from this advancement. As a single-piece system, this technology removes the need for separate materials and installation costs as well as eliminates substrate configuration compromises. They are even manufactured to color coordinate with the aesthetic aspect of modern wall systems.

You can be assured that the final choice of an independent laboratory tested, precompressed, impregnated-foam expansion joint will allow you to "fill the gap" without sacrificing the structural, thermal, sound and life safety attributes expected of today's modern walls, floors and ceilings. W&C

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