By Tom Savoy, Insulfoam

Help your customers understand below-grade insulation

None of your contractor customers would build a single family home or apartment building without insulating the walls and ceilings, right? But, what about not installing insulation on the foundation walls or under the floor slab? These often overlooked parts of the building envelope play an important role in an energy-efficient structure.

When discussing insulation needs with builders, following are key points to help educate them on the importance of below-grade insulation, and in selecting appropriate products.

Why Below-Grade Insulation Matters

While it might seem that soil would adequately insulate building foundations and floor slabs, a lack of insulation in these areas accounts for up to 25% of a building's total energy loss, according to the EPS Industry Alliance. The U.S. Dept. of Energy elaborates on this point, "In addition to reducing heating costs, a properly insulated foundation will keep below-grade rooms more comfortable and prevent moisture problems, insect infestation and radon infiltration." The insulation also helps protect concrete from freeze-thaw cycling, thereby helping minimize cracking, spalling, and frost heave.

One developer that recognizes the multiple benefits of below-grade insulation is the Lend Lease (U.S.) Public Partnerships. For 275 military housing units at the U.S. Army's Fort Greeley and Fort Wainwright in Alaska, the company installed expanded polystyrene (EPS) insulation on the units' foundation perimeters, both vertically and horizontally (away from the house), to trap heat below the slab. This was done to help keep the soil below the slab thawed despite Alaska's often freezing temperatures, explains Greg Starkey, senior construction manager for Lend Lease. The bottom of the slab was also insulated with EPS to retain heat in the slab.

EPS INSULATION was installed below the slab on a 275-unit military housing project in Alaska.
(All photos of courtesy Insulfoam)

Choosing a Below-Grade Insulation

Your customers are flooded with many different marketing claims about insulation, so how do you help them decide what makes the most sense for their below-grade insulation needs?

The two insulation types typically used below grade are EPS and XPS (extruded polystyrene). As with other parts of the building envelope, in below-grade applications it's important to consider moisture resistance and thermal performance (R-value).

Moisture resistance – If you've ever had the misfortune of getting caught in the rain without a coat, you know that a wet shirt does a poor job of keeping you warm. The same is true with insulation—when damp it becomes much less effective at keeping heat in a building.

An insulation's moisture performance is crucial anywhere in the building envelope, but especially so in below grade applications, as these areas often are in contact with damp earth.

EPS and XPS insulations perform very differently when it comes to moisture. EPS tends to absorb small amounts of moisture quicker, but also releases it much faster than XPS does. This has led to confusion about which material performs best, as XPS comes out ahead in the laboratory, while EPS is superior in real-world applications.

Both insulations commonly are evaluated per ASTM 272, *Standard Test Method for Water Absorption of Core Materials for Sandwich Constructions*. In this test, insulation samples are fully submerged in water for 24 hours, then weighed for moisture absorption immediately upon removal from the water.

The problem is this test method is designed to ensure products are manufactured to required specifications, but does not adequately reflect real-world building conditions. Unless a building is subjected to extensive flooding, its below grade insulation is almost never fully submerged as in the laboratory test. And, unless such flooding is prolonged, the test doesn't consider how insulation dries between periods of moisture exposure.

In-the-field tests of insulation exposure to moisture show that EPS outperforms XPS by a wide margin, largely because EPS dries much faster than XPS. In one of many examples, the independent lab Stork Twin City Testing evaluated the moisture content of EPS and XPS buried side-by-side for 15 years on a building foundation in St. Paul, Minnesota. At the time the insulations were removed, the EPS was four times drier than the XPS—the EPS had only 4.8% moisture by volume compared to 18.9% moisture content for the XPS. After 30 days of drying time, the EPS had dried to only 0.7% moisture by volume, while the XPS still contained 15.7% moisture.

R-value – A result of EPS outperforming XPS insulation for moisture in real-world applications vs. laboratory testing, is that it offers better thermal resistance. In the St. Paul 15-year foundation insulation comparison discussed above, Stork Twin City Testing found that the EPS retained 94% of its specified R-value, whereas the XPS only retained 52% of its R-value.

In addition to drying quickly and having minimal long-term moisture retention, EPS also does not experience "thermal drift." This means that EPS insulation retains its published R-value during its time in service. This is because it is made with blowing agents that do not diffuse over time.

Admittedly, no single insulation type is most appropriate in all situations, but many contractors have found that EPS is a cost-effective, high-performance material in many instances, including below-grade applications. "Our research and cost comparisons to other insulations concluded that EPS provides the best exterior insulation results for the price," notes Lend Lease's Starkey.

Beyond foundation and below-slab insulation applications, contractors are also using EPS—in the form of geofoam—to form porches and front steps. The concrete is poured over or around these, requiring less concrete and less labor—saving money on both fronts.

INSULATION was installed both vertically and horizontally to trap heat below the slab and keep the soil underneath thawed despite at-times freezing temperatures.

– Tom Savoy is the technical director of Insulfoam, www.insulfoam.com.