

## TECH TIP # 4

### Air Seal and Dynamic Effective Performance with Closed-cell Spray Polyurethane Foam (SPF)

In response to the demand for more energy efficient, durable, and healthier homes, builders and designers now have an innovative yet proven system called spray polyurethane foam (SPF) to create a superior building envelope to act as the basic building block to meet that demand.

#### **What is “R-value”?**

ASTM C-518 is a laboratory test method used to determine a product’s “R-value” or its ability to *resist* the flow of energy as quantified in a laboratory setting using exact dimensions at ambient conditions. This methodology is an important measure of assess the steady-state thermal transmission properties of insulation materials but hardly describes performance under actual conditions.

A widely observed condition was that convective air currents and air infiltration moving through the building envelope can degrade the thermal performance of low density, large open cell and fibrous insulation products and poorly installed reflective systems. For example, a 4% void area in an R-11 wall will increase heat loss by 15%; the same 4% void area in an R-19 ceiling insulation causes a 50% increase in heat loss. An increase in heat loss represents a decrease in a materials resistance to the flow of energy. The bottom line is this – what you may be paying for with some insulation materials may not be what you are getting.

In a study\* conducted by researchers at the Oak Ridge National Laboratory, among others, measured the impact of airtight construction and the energy savings generated by reducing air infiltration by 20%. Natural air change rates were calculated from the effective leakage area as determined by blower door tests assuming a 5 mph wind load and a temperature difference between indoor and outdoor conditions of 10°F. Heating and cooling loads were then calculated for six different heating and cooling environments from Minneapolis, MN to Phoenix, AZ to determine the equivalent R-value of an airtight home compared to a conventional constructed benchmark with typical air leakage rates. Their findings indicated that to obtain the same heating and cooling loads indicated in an airtight home, a conventionally built home would require whole wall R-values of 2 to 4 times that of the airtight home’s whole wall R-value.

#### **The SPF Approach**

Because WALLTITE® foam systems are closed-cell high-density insulation materials, there are no convection currents or air infiltration-related performance concerns. Both have a design R-value of 6.9 – 7.4 per inch; nearly double that of any other conventional insulation product. In performance tests under actual field conditions with wind loads and maximum temperature variations, the thermal performance of WALLTITE remains constant and dependable while other materials’ thermal performance is degraded.

#### **Building Codes and Expectations**

In many communities local building codes may dictate other applications or variations on the approach described here. The building code exists to insure that accepted construction practices are followed and certain minimums in performance standards are met. They also exist to benchmark innovative applications and concepts to make sure buildings are built safely with sound construction technique.

\*“Performance Check Between Whole Building Thermal Performance Criteria and Exterior Wall Measured Clear Wall R-Value, Thermal Bridging, Thermal Mass, and Airtightness” - ASHRAE Bulletin TO-98-25-4