



**TECHNICAL DATA**

# BUILDBLOCK & BUILDLOCK ICF PERFORMANCE

The R-value is a measure of thermal resistance used in the building and construction industry. It is generally used to indicate how efficient the insulation value of the material or product is. R-value under uniform conditions is the ratio of the temperature difference across an insulator and the heat flux (heat transfer per unit area per unit time, QA) through it or  $R = \Delta T / QA$ . Thermal resistance varies with temperature but it is common practice in construction to treat it as a constant value. (A common method is to standardize the temperature at which the values are reported. (75° typical) (1)

BuildBlock ICF forms consist of 2 panels of Expanded Polystyrene (EPS). Each panel is 2.5" thick. Common accepted values for Type II EPS R-values range from 3.9 – 4.4 (1,2). The R-Value of BuildBlock forms is estimated to be R-21, using an industry average of R-4.2/inch, across 5 inches of foam depth. There are additional factors that help to push the Performance R-value to R-30 - R-50. This performance will reduce the needed size of the HVAC units, and will keep the home at a more constant comfort level.

**BuildBlock Products R-value**

| R-value                 |                  |                     |
|-------------------------|------------------|---------------------|
|                         | Material R-Value | Performance R-Value |
| <b>BuildBlock</b>       | R-21             | R-45-55             |
| <b>BuildLock KD</b>     | R-21             | R-45-55             |
| <b>BuildDeck 8"</b>     | R-23             | R-48-58             |
| <b>BuildDeck 10"</b>    | R-29             | R-50-60             |
| <b>BuildDeck 12"</b>    | R-36             | R-55-65             |
| <b>BuildDeck 12"+2"</b> | R-42             | R-65+               |
| <b>ThermalSert 1"</b>   | +4.2             | -                   |
| <b>ThermalSert 2"</b>   | +8.4             | -                   |
| <b>ThermalSert 4"</b>   | +16.8            | -                   |

NOTE: R-values are calculated using 4.2 R's per inch based on 1.5 lb/ft<sup>3</sup> density. Performance R-values may vary by climate zone, solar orientation, and wall openings. Performance R-values plateau once insulation thickness approaches 10-inches.

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EPS Insulation does not degrade over the normal lifespan of a building and in tests performed by the Expanded Polystyrene Industry Alliance (EPS-IA), it was demonstrated that over extended periods of time, even in direct contact with the soil, EPS will retain most of its stated R-value. Furthermore, EPS exhibits cyclical drying, allowing moisture which is absorbed into the foam, to also dry out from the foam. The report states that Type II EPS (the material used in BuildBlock ICF products) can exhibit a significant drying potential, which "is critical to maintaining thermal resistance (R-value) under severe long term exposure conditions." (3) All building materials exposed to moisture, weather, humidity, etc. will both gain and lose moisture, depending on current conditions. The difference with EPS foam is that it doesn't affect the insulative value. Simply put, EPS foam is like wool socks for your home, even when damp, they still keep you warm.

EPS foam will maintain its R-value, even with significant saturation percentages. In contrast, Extruded Polystyrene (XPS) foam, while having lower moisture absorption rates is more dramatically affected by small amounts of moisture. XPS below grade systems can experience a 10-44% loss of energy savings performance when subjected to moisture accumulation in the range of 8%-16%.

Performance values of ICF vary by temperature, location, number of openings and orientation of the house. Many ICF homes will perform in the range of R-30 – R-50. ICFs will perform better in colder temperatures, because EPS exhibits higher R-values at lower temperatures. Also, properly placed or more efficient windows will contribute to a higher performance value.

Site placement of the home is important in order to take advantage of passive solar gain in the winter while minimizing it in the summer. Large eaves are usually designed into a home to help shield the sun when it's more directly overhead, and allow it to warm the home through large areas of glass when it is lower on the horizon.

Prevailing winds likewise can be directed around the home by trees or landscaping. By using fewer and smaller windows on the north walls, the wind will have less of an effect on the indoor temperatures. Air infiltration which causes drafts and cold spots is eliminated when using ICFs because of the seamless poured monolithic wall created.

Keeping the whole home more comfortable is the goal of any insulation system. ICFs, by controlling conductive losses, and eliminating convective losses, can provide the highest levels of comfort in any weather.

### SOURCES:

Wikipedia, R-value Insulation, [http://en.wikipedia.org/wiki/R-value\\_\(insulation\)](http://en.wikipedia.org/wiki/R-value_(insulation))

Inspectapedia, Table of Insulation Material R-Values & Other Materials' Insulating Properties, <http://inspectapedia.com/interiors/Insulation-Values-Table.htm#Styrene>

EPS-IA, EPS Below Grade Series 104, February 2014, Drying Potential of Polystyrene Insulations Under Extreme Environmental Cycling Conditions

EPS-IA, EPS Below Grade Series 105, March 2014, XPS Insulation Extracted After Field Exposure Confirms High Water Absorption & Diminished R-Value (referencing a study at Oak Ridge National Laboratories (ORNL) in 2012)

Oak Ridge National Laboratory, Measurement of Exterior Foundation Insulation to Assess Durability in Energy-Saving Performance, April 2012, Manfred Kehrer, Jeff Christian.

Autodesk Sustainability Workshop, R-Values and Insulation. <http://sustainabilityworkshop.autodesk.com/buildings/insulation>

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