All Weather Insulated Panels products utilizing a proprietary Class 1 rigid urethane foam system with Honeywell’s environmentally friendly Solstice blowing agent have been rigorously tested in their dimensionally stable and fully cured state in accordance with ASTM C-518 “measurement of steady state thermal transmission” (K factor).

Building components designed to resist thermal conductance will perform differently over time and under various conditions. Thermal degradation can occur for a number of reasons depending on the general characteristics and physical properties of the insulating component or assembly. For instance, the introduction of moisture into an insulating component may not only damage the assembly, but will in most cases severely reduce thermal performance.

Rigid urethanes used to insulate against thermal conductance are sold in several forms. The most common applications are as composite sandwich panels, rigid boards and field spray-on foams. Rigid urethanes at in-place densities of around 2.0 to 2.5 pcf have a very low K factor or high R value. The excellent thermal resistance in rigid urethanes is due to the gases (blowing agents) contained in the cell structure of the foam. Thermal degradation in rigid urethanes will occur if those gases are displaced. One of the basic concepts of sandwich panel construction is that the potential for thermal degradation is significantly reduced because the impermeable factory applied metal facings protect the urethane core against the migration of atmospheric gases into its cell structure. Rigid urethane foams left unprotected or covered with porous membranes will not perform anywhere near the level of metal faced sandwich panels. ASTM C 518 is currently the preferred ASHRAE and CA Title 24 standard for measuring thermal conductance “K” through building materials. In the case of insulated sandwich panels, the metal facings are actually stripped from the test samples which compromises the foam core when aged for 90 days by up to 10%. This is a dramatic illustration of what happens to rigid urethanes that are used without impermeable membranes such as field spray foams or slab style rigid insulation boards. ASTM C1363 allows testing with the metal facings in place and the resulting K factors are always lower (better) with sandwich panels (see attached MCA Technical Bulletin #03-0002).

The Honeywell Solstice blowing agent used in All Weather panels is by far the most stable and achieves the best thermal resistance (lowest K factor) of any of the currently acceptable blowing agents being incorporated in the production of urethane sandwich panels.

All Weather insulated sandwich panels will perform as intended and will not perceptibly degrade in thermal efficiency over the useful life of the installation.
**Background**

Heat transfer is accomplished by convection; conduction and radiation; or by some combination of the three. With foam plastic insulation, thermally efficient gases are trapped within closed cells, which provide the insulating properties. Rigid foam insulation reduces convection as another mechanism for providing thermal resistance. Heat transfer of a material may be expressed by either, how easily the heat passes through it (conductance) or by its resistance to transfer heat energy (resistance).

**How is insulating value defined?**

**Thermal transmittance**, or U-value, is the coefficient of heat transmission (air to air). It is the time rate of heat flow per unit area under steady conditions from the fluid (air) on the warm side of a barrier to the fluid (air) on the cold side, per unit temperature difference between the two fluids. The U factor applies to combinations of different materials used in series along the heat flow path, single materials that comprise a building section, cavity airspaces and surface air films on both sides of a building element, Btu/h· sq ft·°F.

**Thermal resistance**, or R-value, is the temperature difference between two defined surfaces of material or construction that induces unit heat flow through a unit area. It is the inverse of (U-value minus air films) °F·ft²·h/Btu.

**Thermal conductance**, or k-value, is the time rate of heat flow through a body (frequently per unit area) from one of its bounding surfaces to the other for a unit temperature difference between the two surfaces under steady conditions. It is the product of the material thickness (in. or ft) and its U-value, Btu-in/h·ft²·°F or Btu/h·ft·°F.

**What are typical insulating values?**

Insulating values of insulated metal panels vary, depending on the insulating core material and overall thickness. The following table shows how the insulating value is affected by insulation type. Typical insulated metal panels use a polyurethane or polystyrene rigid core insulation.

<table>
<thead>
<tr>
<th>Insulation Type</th>
<th>R-Value / inch</th>
</tr>
</thead>
<tbody>
<tr>
<td>Polyurethane (encapsulated)**</td>
<td>8</td>
</tr>
<tr>
<td>Extruded Polystyrene</td>
<td>5</td>
</tr>
<tr>
<td>Expanded Polystyrene</td>
<td>4</td>
</tr>
<tr>
<td>Mineral Fiber</td>
<td>3</td>
</tr>
<tr>
<td>Cellular Glass</td>
<td>3</td>
</tr>
</tbody>
</table>

*Source: Society of Plastics Industry

**How is the insulating value of insulated metal panels preserved with metal sheathing?**

- The metal face skins contain the insulating foam core and maintain its shape and thickness.
- Installation requires fewer supporting members and fasteners, reducing the amount of thermal shorts in the building envelope.
- The impermeable metal skins protect insulating material from air and moisture which might degrade the insulating properties.
- The metal skins are impervious to gas transmission and therefore prevent the escape of insulating gases from the cellular foam insulation core. This allows the entire panel to maintain its R-value over time.

**How is the insulating value of building panels determined?**

The R-value of components can be determined through testing in accordance with ASTM C1363 at 75° F. The Wall Assembly Overall R-value may be determined analytically from the tested values of each component, or, if practical, by testing the entire assembly in accordance with ASTM C1363.
Conclusions

Insulated metal panels have superior energy efficiency because of their excellent insulating value as a building component. Thermal properties are enhanced by the closed cell nature of the rigid foam core insulation and, because the shape and thickness of the insulating material is maintained between metal profiled panels. The metal wall skins permit the insulating value to remain unchanged over time, by preventing moisture from coming in contact with the insulation material.

Reference


Founded in 1983, the Metal Construction Association brings together the diverse metal construction industry for the purpose of expanding the use of all metals used in construction.

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