RBI Shield FAQ

Multipurpose Reflective Bubble Insulation

Is a vapor retarder an essential part of an insulation solution?

A water vapor retarder may or may not be part of the design depending on the climate zone and the other building components used in that particular section of the building envelope. If air containing water vapor is allowed to come in contact with a cold surface, then condensation will likely occur. Water vapor transmission can also occur even if the building envelope is air sealed or has an effective and properly installed air barrier. Some insulation systems should include a water vapor retarder and some should allow vapor transmission. Building codes and climate zones generally dictate the use of a water vapor retarder -- in short, the envelope is a system and the use should be carefully considered by the building designer.

How will the addition of a reflective insulation with an airspace between the roof deck and the aluminum surface change the conditions that cause condensation?

A reflective insulation below the roof deck results in an interior surface temperature that is greater than the outside temperature (in cold weather). As the inside surface temperature increases, the conditions for condensation become less likely to occur.

What are the conditions that will make condensation occur on the underside of an un-insulated metal roof deck or framing members?

Condensation will occur on any surface when the temperature of the surface is at or below the "dew-point temperature" for an air-water mixture. The dew-point temperature depends on the dry-bulb temperature (measured with an ordinary thermometer) and the relative humidity in the space next to the surface. The dew-point temperature is less than or equal to the dry-bulb temperature. The two temperatures are equal when the relative humidity is 100%. Some examples of dew-point temperature:

Temperature	Relative Humidity	Dew Point
70 °F	50%	50.5 1/4F
70 °F	75%	66.6 1/4F
70 °F	90%	66.9 1/4F

As you can see, condensation can occur when the outside temperature is cold. Insulation below a roof deck will have an inside surface temperature that is above the roof surface temperature. The actual temperature of the inside surface depends on the amount of thermal resistance between the roof and the inside surface. The higher the resistance, the closer the interior surface temperature will be to the inside air temperature. Maintaining a reasonable inside relative humidity (less than 60%) is an important factor in preventing condensation.

How does reflective insulation impact the three modes of heat transfer; Conduction, Convection, and Radiation?

Reflective insulation has little effect on heat transfer by conduction through the air between hot and cold surfaces. Air with an R-per-inch of 5.6 is an excellent insulator when radiation and convection are controlled. The installation of reflective insulation in an enclosed space reduces thermal radiation to near zero. When the reflective insulation is installed to subdivide an air-filled region then convection is also reduced.

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Is the calculated R-value based on the ASHRAE Fundamentals Handbook?

Yes. The ASHRAE Handbook values are a subset of data from the National Bureau of Standards (NBS).

What is reflective insulation?

Reflective insulation is one or more low emittance surfaces installed in an enclosed air space. The more layers within the air space, the better the performance. Reflective insulation in a wall system can be compared to a double or triple pane window with low-e surfaces. Triple pane windows with low e surfaces perform better than a triple pane window without low e surfaces because of the reduction of radiation (low emittance) across the air spaces.

Air inherently has an R-per-inch value of 5.6, and is an excellent insulator when radiation and convection are controlled. The ASHRAE Handbook has tables with values for various enclosed air spaces (0.5", 0.75", 1.5", 3.5", etc.) with high emittance surfaces (0.82 for common building materials) and values for air spaces with low emittance surfaces facing the enclosed air space (0.05 for low emittance materials like aluminum). Simply put, adding a low e material makes the enclosed air space perform better. A multilayer reflective insulation system in a wall cavity improves this system by further reducing radiant heat transfer and adding additional "panes", a two layer reflective insulation could be compared to a double paned window; a three layer to a triple pane window, and so on..

The installation of reflective insulation in an enclosed space reduces thermal radiation to near zero. When the reflective insulation is installed to subdivide an air-filled region then heat transfer by convection is also reduced. Fi-Foil has single layer, two layer, three layer and even honey-comb layer reflective insulation products for various building applications, each with different performance levels and attributes for the particular application. These products also work very well with other types of mass insulation as hybrid systems by using the best attributes of each of the technologies (e.g. spray foam is great for air sealing and can have a high R--value per inch of thickness -- fiberglass and cellulose is an inexpensive material to reduce convection in the cavity). In some wall systems, especially wall cavities larger than 1.5", a combination of reflective insulation with one or more of these mass insulation products, addresses all the modes of heat transfer -- often more cost effectively than one of the technologies used alone.

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