What is a Vacuum Insulated Panel?

Vacuum Insulated Panels, or VIPs, are a relatively new product making their way into buildings in the United States. They can be used as stud cavity insulation or as continuous exterior insulation on structures, just like other types of insulation.

As the name describes, VIPs consist of a panel with the air inside of it removed to form a vacuum. It isn’t a perfect vacuum, but the air pressure inside the VIP is considerably less than ambient pressure. The panels are airtight and resistant to water vapor absorption. They make good insulators because the lack of air almost completely eliminates conductive and convective heat transfer through the center of the panels. Typical panels are fairly small, 1 x 2 feet or 2 x 4 feet, and about 1 inch thick.

VIPs have an R-value of approximately R-25 per inch at the center of the panel and about R-20 for the whole panel (exact R-value depends on the manufacturing process and materials). The center of the panel will have a higher R-value than the edges, much like a window, as edges provide a thermal bridge for conductive heat transfer and lower the R-value of the entire panel. Even the whole-panel R-value is considerably higher than other insulations: fiberglass batts are around R-3.8 per inch, EPS is around R-4 per inch, and XPS is around R-5 per inch.

VIPs are installed on the sheathing plane of a building using adhesive. The material surrounding the VIPs in a wall is very important, because it helps protect the VIP from damage during installation. However, because the VIP is not continuous, the lower R-value surrounding insulation will bring the total wall R-value down. This is similar to what happens in a traditional stud-framed wall with fiberglass batts in the cavities – the wooden studs provide a thermal bridge for heat to escape and reduce the total wall R-value. With VIPs, even if the “studs” were made of EPS insulation, the whole wall R-value will still drop more than the fiberglass wall drops with the addition of wooden studs. It is important to consider how to provide structure for VIPs without providing too much thermal bridging.

As with any new building product, there are potential disadvantages of using VIPs that must be considered. First, VIPs must be manufactured in a factory and then shipped to the building site. They can’t be cut or modified in the field. This means that detailed plans must be completed prior to construction and there is no flexibility in modifying them, unlike a traditional stick-framed wall.

VIPs also cost quite a bit more than other types of insulation. In addition to the more intensive manufacturing process, the panels have to be shipped to the building location. There are currently only a few manufacturers in the United States, so this could be quite a long distance.

Finally, panels will naturally lose some vacuum over time. When they do, the R-value drops substantially. Manufacturers currently estimate the lifespan of the vacuum at 25 to 50 years. The seals must be treated carefully during the shipping and installation process to protect the vacuum. And putting a nail through a VIP damages the R-value of the panel much more than with other types of insulation. Losing the panel vacuum due to a hole in the panel reduces the panel’s R-value by more than half, often bringing it down to around R-6 per inch.

VIPs in Alaska

VIPs have a number of applications throughout the world, including refrigeration equipment, vending machines, shipping containers and construction. A few companies are manufacturing them in Alaska.
the United States, including Nanopore and Dow Corning. The new engineering building at the University of Alaska Fairbanks will use Dow Corning VIPs in a test wall system, which consist of fumed silica (basically glass powder) wrapped in a layer of plastic and aluminum. In effect, the plan is to replace some EPS foam in the wall system with a small vacuum panel. UAF researchers are planning to measure the installed R-value of the panel to study its appropriateness for buildings in our climate.