

Product category briefing: super-thin insulation

Heat flows from hot to cold at a rate determined by the temperature difference, and the effect of thermal insulation is to resist the flow of heat by conduction. Different materials have different thermal conductivities. Metals have high conductivities—they are very effective at transporting heat—while expanded polystyrene, for example, has low conductivity, meaning that it resists heat flow. Air and other gases are poor conductors of heat as long as they are held still, as is the case in the microscopic pockets of foam and fibrous insulation.

The effectiveness of insulation depends on its conductivity—the lower the better—and its thickness. There may also be some benefit in the insulation having a highly-reflective surface, which reduces the absorption of radiant heat at the surface facing the heat source and the emission of heat from the colder face. Radiant effects are important when the exposed surface of the insulation faces an environment at a significantly different temperature.

There are vendors who claim superior performance from products very much thinner than normal. These fall into two categories: paints and multi-foil composite quilt.

Paints: because of their relative thickness compared with conventional foam or fibre insulation, insulating paints would need to have thermal conductivities a thousand times lower than air. On the contrary the solids in the paint will have moderately high conductivity, and equivalent performance would only be achieved if the paint layer were at least double the thickness of conventional insulation.

Multi-layer foil: the inner reflective layers are hidden behind the outer foils and serve no purpose other than to create a fraudulent impression of superior engineering. These products are comparable to simple foam and quilt insulation of the same thickness. The outer foil surfaces will work as vapour barriers but have negligible heat-retention effect because they are at temperatures close to the surfaces they face and may even be in contact, which enables heat conduction.

Vendors of these products are exploiting the fact that most potential customers do not have enough scientific knowledge to expose the falsehoods in their claims, which are often dressed up with plausible-sounding pseudo-science, and supported by apparently favourable test results and endorsements obtained from gullible customers. Their test results, however, are usually based on flawed methodology and they commonly refuse to accept standard testing methods.

The salesmen often have no scientific or technical training and believe their own promotional material. Sometimes they are themselves the innocent victims of unscrupulous franchisors. Either way they are motivated by profit with no respect for the truth, and their products are worthless at best.

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