

Insulating Steel Roofs

The critical considerations in the design and insulation of flat or low pitch steel roofs are:

- Simplicity of installation
- Thermal performance
- Initial cost
- Life expectancy
- Maintenance cost
- Lifetime cost.

Conventional insulation approaches

Low-rise commercial/industrial buildings typically have metal roofs with very large surface areas in relation to the rest of the structure. It is vital to properly insulate these roofs to conserve energy and to control condensation. The Icynene Insulation System[®] offers an alternative to the conventional insulation systems commonly used to insulate roofs. The conventional systems are a) built up exterior insulation and b) interior glass fiber systems.

The Icynene Insulation System[®]

The Icynene Insulation System[®] is a two component, spray-in-place insulation system. It is an open celled low-density (0.5 lb/ft³ or 8.0 kg/m³) product. It is installed by spraying the materials in liquid form on the underside of the roof deck. The liquid immediately expands into foam at a rate of 100:1 in a matter of 10 seconds. Icynene[®] forces itself into every corner and crevice and adheres to everything it touches. Icynene[®] has a thermal resistance of R-3.6 per inch (RSI-0.62 per 25 mm). Icynene[®] provides a continuous barrier to the movement of humid indoor air, protecting the steel deck from condensation.

When using Icynene[®], the roof deck is installed on purlins mounted above open web joists or red iron framing, as usual. Weather sealant is applied on the steel

deck. The depth of the purlins must be adequate to accommodate the thickness of insulation specified, plus 2 inches. A spacer is installed over the top of the purlins prior to laying the roof to provide a thermal break between the purlin and the roof. The preferred thermal break material is isocyanurate strip fastened with adhesive. The choice of roofing deck profile is governed by the goal to provide as little contact between the decking and the purlin as possible. Icynene[®] will fill all the spaces between the purlins and the roof deck, creating an additional thermal break.

The maximum thickness of Icynene[®] recommended in most areas of the country is 5.5 inches (140 mm) or R-20 (RSI-3.4). At this level the heat-flow through the roof is reduced by about 95%. Increasing thickness to 8.5 inches (216 mm) or R-30 (RSI-5.3) will increase cost by about 30% but reduced heat-flow by only 1.7% to a total of 96.7%. This is rarely justified.

Icynene[®] is delivered to the site in liquid form in steel drums, each set of two drums containing 15,000 board feet of insulation. In fact, one truckload of Icynene[®] raw materials is equivalent to as much insulation as 100 trucks loaded with board insulation materials or 30 truckloads of glass fiber. Site traffic and site clutter is reduced. In addition to the greatly reduced raw material requirements, Icynene[®] can be installed in all weather conditions. This limits weather-related interruption of construction schedules that plague conventional insulation systems. When Icynene[®] is specified, the building can be closed-in faster and interior work can proceed sooner.

Installation

The licensed Icynene dealer comes fully equipped with spray equipment, electrical power and compressed air. All equipment is mounted on a truck or trailer that comes with up to 300 ft of hose, allowing the installer, from one location, to insulate a wide area before moving. The only additional on-site equipment



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requirement is a man-lift, from which to work. Application rates average about 15,000 board feet per day.

Icynene® adheres well and permanently to steel, even if it has an oil-based coating or moisture is present due to condensation.

Icynene® can be installed in extreme cold. Icynene® installation is proven in Barrow on Alaska's North Slope, on the Arctic Ocean, at minus 40 °F/C temperatures. Icynene® is flexible and will not shrink or de-laminate with dimensional changes in the surface to which it is adhered.

Icynene® will not shrink or lose R-value with time. Its cells contain only air.

Icynene® is an inert material. It contains no CFCs or HCFCs to cause corrosion of metals and fasteners with which it is in contact.

Icynene® requires no additional vapor protection. It is an excellent air barrier and eliminates the problems resulting from the movement of airborne moisture. It prevents moist air from coming in contact with the roof deck.

It is self-supporting. It requires no additional support system, as it adheres to steel very well.

After installation, an interior finish usually covers Icynene®. The choice of the interior finish will be dictated by appearance, maintenance, and fire rating requirements. Interior finish options include, but are not limited to: gypsum board; suspended acoustical tile; vinyl faced material; and steel sheeting. In some situations, such as agricultural buildings, it may be possible to leave Icynene® exposed. It can be painted, but cannot be power washed.

Maintenance

Once installed, Icynene® requires no maintenance, even if the material gets wet from roofing leaks. Roof leaks onto conventional insulation materials usually mean disruptive and costly replacement, whereas Icynene® only needs to dry out. Water is not absorbed by Icynene®; it drains straight through the material,

making the search for the leak much simpler. Icynene's® thermal and air sealing properties do not degrade with wetting and drying cycles. Similarly, condensation will not occur on roofs insulated with Icynene®, due to the lack of air movement through the material to colder surfaces.

Summary of Icynene's® advantage versus exterior insulation

- Installation is not weather dependent. No delays because of rain, cold, heat, wind or snow.
- Materials and installation are less expensive.
- Installation is faster, because Icynene® is installed in one step.
- Construction proceeds faster.
- Purlins do not require painting.
- Site traffic and material handling is reduced
- Roof leak maintenance is much less expensive.
- At end of its life, roof replacement is much simpler

Summary of Icynene's® advantages versus interior insulation

- No delays. Installation is never delayed because of rain, cold, heat, wind or snow.
- Site traffic and material handling is reduced.
- Roof maintenance after leaks are less expensive.
- Purlins do not require painting.
- Purlins are thinner.
- Energy performance is superior and energy costs are lower, due to perfect fit.
- Moisture/condensation problems are eliminated.
- No maintenance or replacement required of insulation.
- Interior finish can be repainted to maintain interior appearance.

